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TRACKINGUP: HOW COMPUTERIZED PROGRESS TRACKING AND LESSON
PLANNING IMPACTS THERAPEUTIC RIDING

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ABSTRACT

Therapeutic riding has recently gained prominence as one of the more effective forms of physical and animal therapy. However, despite holding a position in the modern therapeutic profession, therapeutic riding centers have lagged behind their counterparts in the use of technology. Most therapeutic riding centers operate on a purely paper-based system of record keeping. Building a computer application to manage the planning and record keeping aspects of any therapy is a challenge that has still not gained a satisfactory solution. In the realm of therapeutic riding, the challenge is further complicated by a domain consisting of technology resistant therapists with a long-standing dependence on legacy systems.

 As no computer application currently exists in this realm, this study aimed to build one and trial it with three different therapeutic riding facilities. This application, named TrackingUP, aimed to increase the standardization of recording keeping between therapists, assist therapists in their session planning, and provide further insight into patient progress tracking. The study focused on identifying the therapeutic riding specific design principles necessary to develop an effective application that is acceptable to the instructors and provide a solid foundation for future development in the field. The study revealed a larger than expected level of acceptance among participants with all of them stating a desire to keep using the application after the end of the trial. Results of this study could be used to develop more effective and useful applications within the therapeutic riding profession.

TABLE OF CONTENTS

iv

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

Chapter 1 Literature Review

History of Therapeutic Riding

Since Antiquity, medical professionals have used a form of therapy that combines physical, psychological, emotional, and animal therapy into one session. (Xenophon. and Morgan, 2006) Today, it is known as therapeutic riding. It consists of a planned sequence of exercises performed on horseback for therapeutic gains varying from the purely physical to the psychological. The first recorded use of therapeutic riding began when the Spartans assigned horses and riding lessons to help veterans with what would later be known as PTSD. After seeing this innovative therapy in the fifth century B.C.E., Xenophon declared "there is something about the outside of the horse that is good for the inside of a man," (Xenophon. and Morgan, 2006) a quote often attributed to many other leaders through the years, including Winston Churchill and Ronald Reagan. The longevity of this quote alone testifies to the efficacy of using horses to heal psychological wounds. It soon became common practice for physicians to prescribe "horse medicine." This practice spread rapidly through the Mediterranean as doctors discovered their patients often benefited in unpredictable and amazing ways from this equine therapy. Yet the fall of the Roman Empire saw an end to this practice. Around the turn of the Twentieth Century, English doctors rediscovered the concept of therapeutic riding and began to redevelop what the Ancient Greeks began. After witnessing two world wars, the practice has spread and evolved to take in the needy from all walks of life across the globe. Over the years, therapeutic riding has treated patients with conditions as diverse as autism and spinal injury. (American Hippotherapy Association, 2014)

Therapeutic Riding in the Modern Era

Today, therapeutic riding facilities cover most Western countries. The Professional Association of Therapeutic Horsemanship (PATH) of America has over 877 registered therapeutic riding centers with 7,546 equines—including horses and donkeys—and around 54,500 volunteers to help therapists in the treatment of patients of all disabilities and ages. This adds up to an annual budget of over $1 billion. (PATH Intl, 2017) With diagnoses of psychological, behavioral, and chronic physical conditions on the rise, the therapeutic riding profession is still growing to this day.

For a profession growing so rapidly, some medical professionals are still uncertain of its exact benefits. The efficacy of therapeutic riding varies drastically between patients. For some, therapeutic riding is an escape from the world that torments them, for others it is even more meaningful. For people in wheelchairs, it is the one time in the week that they do not have to look up at the world from the confines of a chair. In certain cases, the movement of the horse so closely mimic that of walking that it has stimulated the synapses in the brain to reteach the body how to walk. For hypertensive cerebral palsy patients, it relaxes muscles and allows for exercises impossible at any other time. For autism spectrum patients, it is a time of relaxation in a nonjudgmental environment that often leads to increased socialization. (Knowlton, 2017)

That nonjudgmental nature of the environment is crucial. In order to maintain the relaxed air for patients, therapeutic riding facilities remove all pressure to "get better." Instead, the facilities focus on skill building. Instead of being a patient in need of "fixing," riders become students learning new skills. Their therapists call themselves instructors and each session is called a lesson. In this way, patients have a chance to separate themselves from their disease. They have a chance to become *more.* To their instructor, they are not a patient with something wrong with them, they are a student with something to learn. (Guggenheim, 2017) For the purposes of this paper, the same terminology will be adopted. However, it is important to note that, while therapeutic riding focuses on learning, it is also a mainstream

form of physical and psychological therapy accepted by many health insurance plans and offered by the Department of Veteran's Affairs to veterans with PTSD. (Dunkel, 2017)

Current Practices in Therapeutic Riding

Despite being one of the most used forms of therapy for certain neurological conditions, the therapeutic riding profession remains mostly outside the digital age. The majority of therapeutic facilities will have a static website and reach new students and volunteers primarily through word of mouth. With a few notable exceptions, most require paper forms from students and use a paper-based system for record keeping. (Knowlton, 2017) These records range from forms filled out by hand to dedicated notebooks owned by the instructor. Often instructors develop their own form of record keeping that is unique to them and their students. (Polles, 2017)

This haphazard nature of record keeping makes it difficult for substitute or new instructors to be adequately briefed on a new student's needs and goals. (Van de Stolpe, 2017) Additionally, without combing through the handwritten notes for hours, there is no way to track student progress over time. This means that considerable portions of time are set aside to generate periodical progress notes through analyzing a notebook full of lesson notes written in haste. Most of the time, progress is primarily tracked by asking the instructor how they think the student is doing overall. (Guggenheim, 2017) That method, however, is inherently biased and relies on the accuracy of human memory and interpretation. With no standardized method of note keeping, gaining an understanding of a student's status is a daunting task.

Computerization in the Physical Therapy Industry

While computerizing therapy notes is new to the therapeutic riding profession, it is by no means a new concept to the therapeutic world at large. The use of technology to assist therapy exploded onto the

scene when the Massachusetts Institute of Technology released ELIZA, a simple artificial intelligence

that asked open-ended questions and proved to be one of the most successful talk therapists of the day.

(Rzepka and Araki, 2016) Since then, the worlds of technology and therapy have been closely

intertwined. Today, physical therapy facilities such as NOVACare have state of the art websites for

patients to find the facilities, talk to clinicians, and fill in forms describing the exact nature of their needs.

No paper forms or records are required. ("NovaCare Rehabilitation", 2017) Outpatient therapy is now

combined with computer applications the patient can take home. These apps provide the patient with easy

tutorials and instructions for exercises they can do at home. On the therapist side, the apps make it easy to

track patient completion of tasks and advise on more exercises and strategies to help the patient progress.

More extensive applications allow the therapist to track patient progress towards a goal and use exercise

databases that recommend future programs and methods. All the records are stored in easy to use,

searchable databases that make patient transfer simple and allow therapists to share ideas and exercises.

The entire process, from admission to therapy completion is monitored and guided by highly intelligent

computers. (Bouck, 2015) The following sections discuss the creation and trials of such computer

applications.

Rumpfzirkel: Physical Therapy Goes App

Every physical therapy program requires follow up with patients performing exercises under the

guidance of therapists. However, most patients do not follow this through or are given sub-optimal

exercises that are not tailored to their needs. (Dunkel, 2017) Researchers at Balgrist University Hospital

developed an innovative solution to this problem. They built a computer application known as

Rumpfzirkel in order to conduct a usability study. The application provides an intelligent database of

exercises to both physical therapists and patients to better tailor their exercise program. This database

includes pictures, videos, and instructions for each exercise to help users form medically appropriate

exercise programs. Each exercise has a difficulty rating and customizable length. The application also allows users to log each time they used one of the exercises and the results. These logs can then be used to track progress through the application. (Buck, Dyer, Tessendorf, 2015)

Upon creation of the application, the researchers at Balgrist University Hospital conducted a usability study to look into the efficacy of such applications in the field of physical therapy. (Buck, Dyer, Tessendorf, 2015) Within a span of one year, over 1400 patients downloaded the iOS and Android application. Usage data and returned feedback allowed researchers to analyze the user acceptance of the application. They found that the simplicity and adaptability of the application lead to its success in motivating patients to complete the exercises. The ability of the user to customize each exercise plan to their unique needs also increased acceptance and motivation to use. Going forward, the researchers want to analyze the longevity of the application as well as its ability to cater to different needs, such as increasing leg strength. (Buck, Dyer, Tessendorf, 2015)

In conclusion, the study demonstrated the ability of intelligent databases and progress tracking applications to improve physical therapy. Two features to note in the design of future applications are maximized simplicity and customization. Especially in a field unused to computerization, such as therapeutic riding, simplicity will prove essential for user acceptance. Since each patient—or, in the case of therapeutic riding, student—is unique, an app that forces users to follow specified paths would not work correctly. (Knowlton, 2017) The creators of Rumpfzirkel realized this early on and adjusted their designs to match. (Buck, Dyer, Tessendorf, 2015) Not only does Rumpfzirkel prove the potential for such an application used in physical therapy, but also demonstrates the most important features of applications in this field.

Computerized Fall Preventions

The Geriatric Special Group of Hong Kong Physiotherapy Association developed an application

with a domain similar to therapeutic riding in more than one aspect—a target audience focused on gentle physical therapy and with limited technological experience. The primary function of this app is to create a usable database of exercises generated by the physiotherapist that other physiotherapist across the country could use with their patients. In a more advanced version, the application will also have a patient facing side that allows them to keep up to date with their exercises at home. This way, physical therapists can provide "exercise prescriptions" to their patients. The primary questions of this article were similar to most application-centered research questions: can it be made and will it work? As of the date of publication, development on the application is still on going. However, the prototype contains a feedback option as well as regular emails notifying physiotherapists of a patient's progress and completion. While the application is still under development, early tests have proven its efficacy. (Wong, Masters, & Tse, 2017) The application standardizes an approach to fall prevention in elderly adults and encourages consistency throughout a therapy program. This standardization may also benefit therapeutic riding as it is also a field that has many different possible avenues to therapy. This points to a necessary feature in any application within the therapeutic riding field—it must encourage a standard across instructors that allows one to easily pick up another's students.

Research Questions

Based on the above research and preliminary domain analysis, the following study was designed. The main focus of this study is to determine the usability of a computer application in therapeutic riding lesson planning and note keeping. For this paper, the term usability refers to the ease of user experience in the successful operating of the application. This includes the entire use of the application from data entry to report generation. As such, the following research questions were generated:

1. What are the barriers to instructors adopting computer applications in support of therapeutic riding programs?

2. Will defining and tracking riding objectives through a computer application change the way instructors plan or track lessons? Why or why not?

3. What are some general design principles for applications to support therapeutic riding?

Unfortunately, no such software tailored to therapeutic riding currently exists. To answer these question, the researcher built the TrackingUP system. TrackingUP is a platform independent java application running on two SQL databases. Upon creation, the system was given to instructors across multiple therapeutic facilities for a two month trial and usability study.

Chapter 2 Design

Both instructors and students stand to gain from an application for therapeutic riding similar to those already being used in physical therapy. For the purposes of this study, such an application was created and tested in a two month trial. This therapeutic riding application, named TrackingUP, originally used of the base feature set of Rumpfzirkel and was then expanded and refined through interviews with therapeutic riding instructors.

Eleven therapeutic riding instructors were recruited for a series of design solicitation interviews. These instructors varied in experience from just over a year to several decades of teaching. Together they covered a wide range of focuses that included both adults and children of physical, mental, and social disability. All taught therapeutic riding at PATH certified facilities.

The first set of interviews was a preliminary domain analysis to gain a basic understanding of user needs and restrictions. This was an unstructured ten-minute interview that demonstrated the alignment between the users of Rumpfzirkel and the therapeutic riding instructors. This first interview focused on establishing current practices in note keeping and student management with a view on how they might be improved. The results of this interview were processed into a preliminary design of the application's core functionality.

The second interview set was semi-structured. These interviews lasted between fifteen minutes to half an hour and went into detail about what the users would require regarding the TrackingUP application and what they could expect. In this interview, participants were encouraged to sketch out possible views and processes. Users went into detail regarding their routines and desires for the system. Design ideas for the application were refined with certain features being given priority.

In the third and final interviews in the design process, participants were given click through prototypes to test the usability of the application and discover any additional design needs. These sessions

lasted thirty minutes to a full hour as the users were asked to run a think aloud usability test on the preliminary prototype. Results from these tests went into design updates and bug fixes within the prototype before development began. Participants were given the opportunity to review these updates in an optional, shortened interview.

Many requirements were recorded during these interviews. For instance, TrackingUP stores a searchable database of exercises and techniques for instructors to use in lessons. This database uses a ranking system to establish which exercises work best towards each goal. Using these rankings, the system can recommend new exercises to instructors based on their student's health condition, restrictions, and goals. This way, instructors can use the system to share information with one another on which methods work and in so doing optimize their lesson plans. While this is similar to the users of Rumpfzirkel, the therapeutic riding instructors needed multiple classes of restrictions on their exercises including "rider level," "condition," and "cautions." This contrasts to Rumpfzirkel's single restriction of difficulty level. They also wanted a "secondary benefits" field to indicate potential benefits of an exercise outside the therapy's initial scope.

Additionally, therapeutic riding has needs that are unique to other forms of therapeutic applications. For instance, the interviews established that students cannot have access to the application without compromising the carefully cultivated nonjudgmental atmosphere of therapeutic riding discussed in previous sections. This means that the use of the application must be limited purely to instructors in their lesson planning and recording.

The interviews also uncovered an alarming fact. The therapeutic riding profession has such little technology integration that the practitioners have very little experience using computers in their day to day workings. For instance, several stated their resistance to smartphones while one explained she had never learned to type with a traditional QWERTY keyboard as she never needed to use computers. As a result, many demonstrated a resistance to the idea of integrating technology into their daily routines. This could prove a large impediment to the adoption of the TrackingUP system and dramatically affect the

design. Given the momentum of the paper-based legacy system, the primary focus of the TrackingUP

design must be simplicity. The application must be as intuitive as possible with the complexity handled in

the back-end. Given this, a low user acceptance rate is predicted for this first application trial. In later

studies, applications can be given increasing levels of complexity once the users have grown accustomed

to computers in their everyday tasks.

Requirements and Design Principles

After analyzing current trends in similar applications and interviewing multiple therapeutic riding

instructors, the following requirements were established:

Table 1 Design Requirements

Requirement	Reasoning
Transparent interface	Some therapeutic riding instructors are unused to technology, working in a profession that runs on a paper-based system. As such, a new computer system will intimidate the users and will be rejected if it is not intuitive.
Minimal user action required	Lesson notes are written every day in a fast-paced environment. As such, the system should limit the amount of actions required by the user to enter a lesson, instead taking no more time than their previous paper-based system required.

Customizability	Every therapeutic riding instructor has a different system in place for taking their own notes. This means that an application designed for all of them must accommodate all of their different systems.
Adaptability	Every student is unique and every session is unique. Some days, a student may not work on any exercises at all but that does not mean no breakthrough occurred. The application needs to allow for these differences and permit instructors to make subjective judgement calls.
Instructor overrides on progress grading	As the field of therapeutic riding is so diverse, no algorithm can accurately say how a student is doing. For instance, a student may have perfect balance on a horse but is still unable to complete an exercise linked to that objective for unrelated reasons. As a result, instructors need the capability of overriding the algorithm with regards to student progress.
Report printing	PATH, the main regulatory body of therapeutic riding in America requires regular reports on students. The application will need a quick way to print lesson notes within that format. Additionally, each therapeutic riding facility maintains its notes differently. The application will need the ability to print reports with the information required by that barn.

System Configurations Customizability	As each barn stores different information about students and lessons, the application will need to allow a system administrator to customize the data and views of the application.

Use Cases

At its highest level, TrackingUP is split into two applications—a library and a progress tracking application, known as TrackingUP Library and TrackingUP respectively. Each application has separate use cases discussed below.
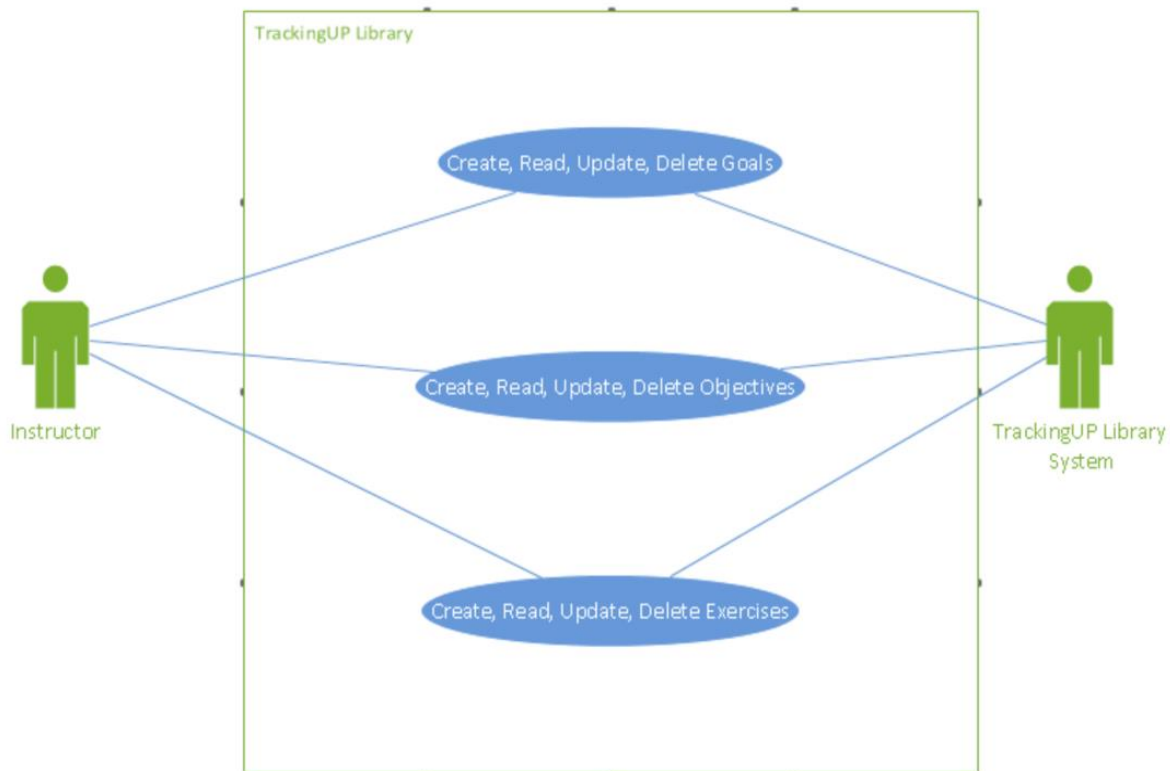
TrackingUP Library

Figure 1 Use Cases for the TrackingUP Library Application

The library portion of the application acts as the name implies. It is a storehouse of knowledge for instructors to use as reference. It stores exercises, objectives, and goals with instructions on how to use them. As the sole function of this application is the storage of knowledge, the use cases for this application are simply to create, read, update, and delete exercises, objectives, and goals.

The goal, objective, exercise hierarchy is central to TrackingUP and can be seen in the below screenshot from the system. A goal, such as "Posting Trot" in the below screenshot, is a yearlong target for the student. This is a large milestone. Each objective, such as "Straight Lines" and "Steering" are smaller, month long targets that build towards accomplishing a goal. Finally, exercises, like "Weaving Cones," are day to day activities that students can perform in a lesson in order to get closer to achieving an objective. This hierarchy is based on PATH standards. (PATH Intl, 2017) For more information on goals, objectives, and exercises, see the **Database – TrackingUP Library** section.
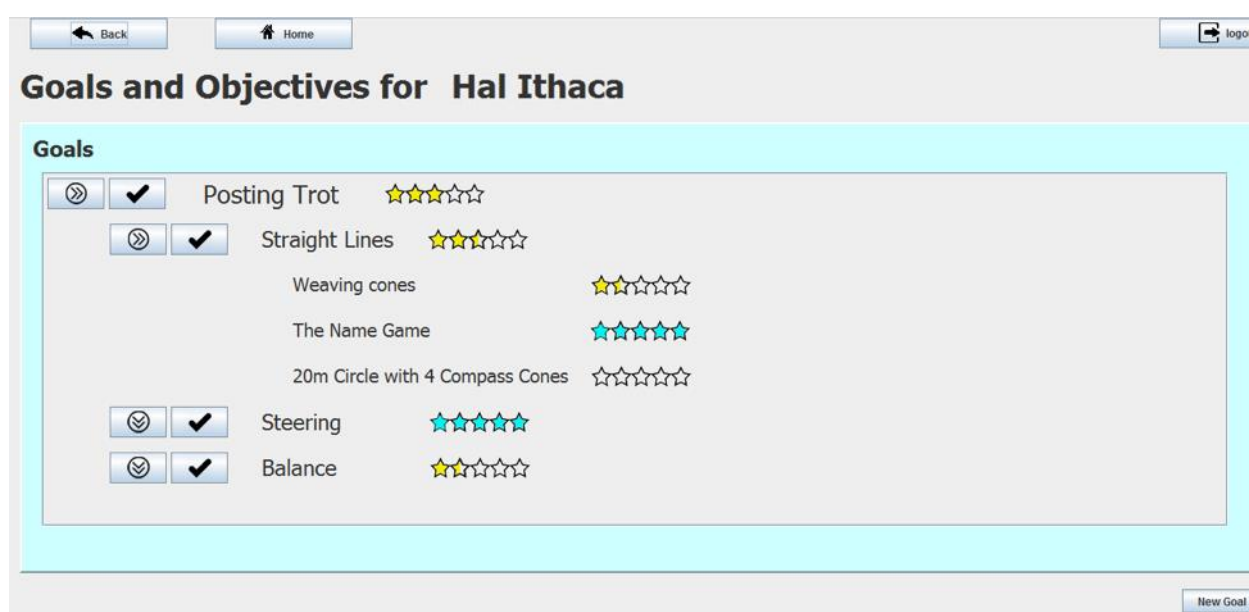

Figure 2 Student Progress Tracking Page Screenshot

TrackingUP

The second application, TrackingUP, is more complex than the library, as demonstrated by the use case diagram below. The following section describes each use case in more detail.
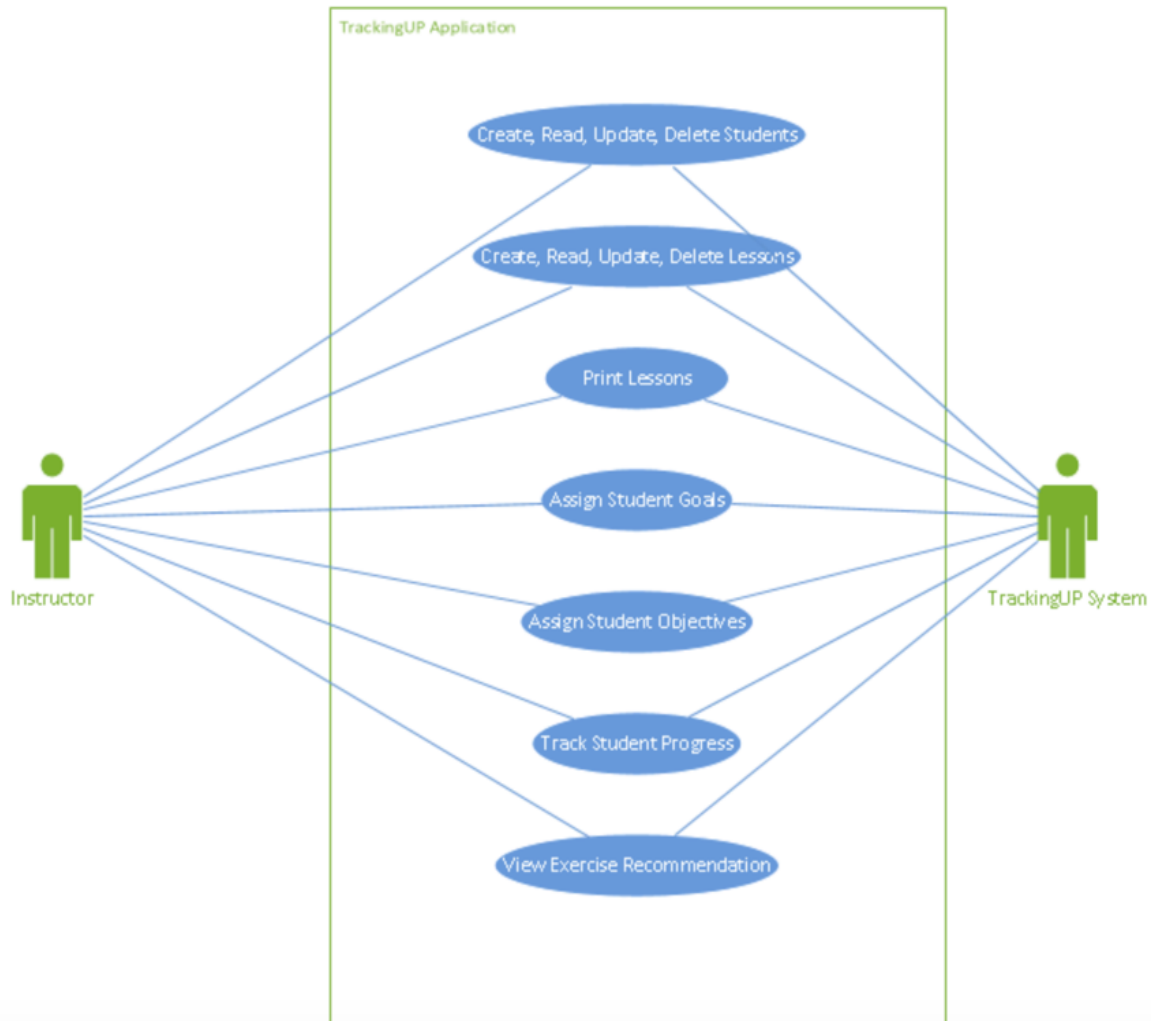

Figure 3 Use Cases of TrackingUP Application

Create, Read, Update, and Delete Students

In order to track students, instructors need to be able to enter students into the database, update their information, and delete students if necessary. Another important function of the application is to

allow new instructors to immediately get detailed information on each student, as shown in the read use case.

Create, Read, Update, and Delete Lessons

As the main part of this application is storing lesson data on students, the main use case is creating, reading, updating, and deleting lessons. These lessons should be accessible from two lists: a list of lessons linked to a selected student and a list of lessons linked to a selected instructor. Each lesson should contain a list of exercises that were used that day as well as any information deemed necessary during design interviews with the instructors.

Print Lessons

Instructors must be able to print out a physical report of lessons. This could be a single lesson, all lessons for a selected student, or all lessons for a selected instructor over a period of time. As these reports may be given out to care givers, there must also be an option for instructors to remove the lesson ratings from the printed reports. This was a requirement of instructors to retain the non-judgmental atmosphere of therapeutic riding.

Assign Student Objectives

As each student is different and evolves, instructors need to be able to create, read, update, and delete student objectives that will be tracked through the exercises used in the lessons. These student objectives would be instances of the objectives stored in the library that are linked to a specific student.

The instructor must be able to choose which student goals and exercises these are related to through the application and not be forced to conform to the library's existing linkages. Additionally, instructors need an override to state if an objective has been completed regardless of what the system interprets. Student objectives are further explained in the **Database – TrackingUP** section.

Assign Student Goals

Similar to student objectives, instructors must be able to create, read, update, and delete student goals. They should be able to link student goals to student objectives without issue to library mapping and override the system to say if the goal has been completed. For more information on student goals, refer to the **Database – TrackingUP** section.

Track Student Progress

The application must provide instructors with a snapshot of student progress and a more detailed breakdown. The system should track all student data in real time to provide constant analysis for the instructor in an easy to read format.

View Exercise Recommendation

The benefits of having the application linked to the exercise library is that, when recording and planning lessons, the system can provide instructors with an ordered list of exercises that are linked to a given student's objectives and goals. This way, instructors can easily find new approaches to try with difficult students or search for inspiration in what previous instructors have found helpful.

Database

       As previously mentioned, the TrackingUP project was split into two sub applications with two linked databases. The following section describes the two databases. The first was the TrackingUP Library. This application stored a library of exercises for instructors to use in their lessons with students. In the second application, TrackingUP, instructors can enter lessons and track student progress.

       Please note, the below Entity Relationship Diagrams have been abridged for the purposes of legibility. For extended versions, please refer to **Appendix B Entity Relationship Diagrams Extended.**

TrackingUP Library
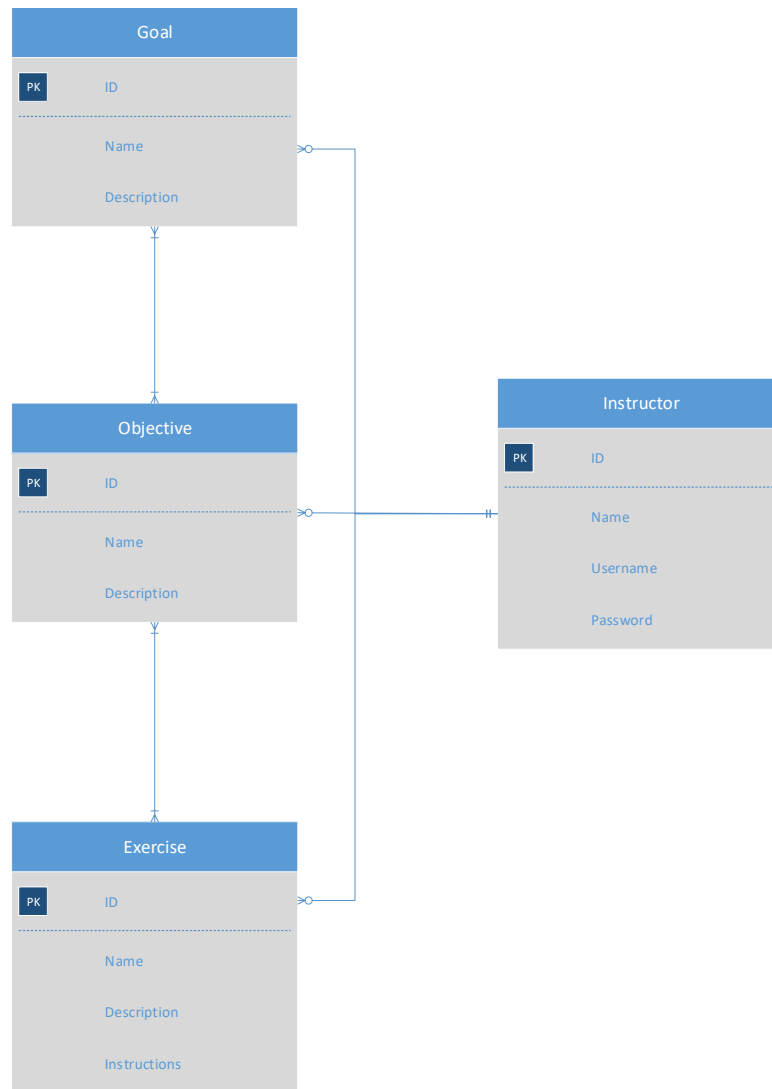
Figure 4 Limited Entity Relationship Diagram for TrackingUP Library Application

The TrackingUP Library database had three main datatypes: exercise, objective, and goal that were linked with many to many relationships. The fourth datatype is the instructors who can log in and create each of the others and thus take ownership of them. The below table explains the first three in more detail.

Table 2 TrackingUP Library Datatypes

Name	Description
Exercise	Exercises are the smallest installment of therapeutic riding. They are the day to day tasks the instructors could have the students perform in each lesson. This could include having the student guide the horse around a series of cones or use a comb to brush the horse's mane. Each exercise can build towards several objectives.
Objective	Objectives are longer term than exercises. They are small, monthly targets for the student to achieve. Every objective has to be measurable and attainable to meet PATH standards. An example of an objective would be maintaining consistent balance throughout a lesson. Just as exercises can build to several objectives, each objective can build to several goals.
Goal	Goals make up the main intent of the application. These are the yearlong targets of the students. This could include riding independently with no assistance or getting the horse to trot over a small jump. Like objectives, goals must be measurable and attainable to meet PATH standards.

All the material is shared with every user of the application so that instructors can share the exercises, objectives, and goals they use for their students.
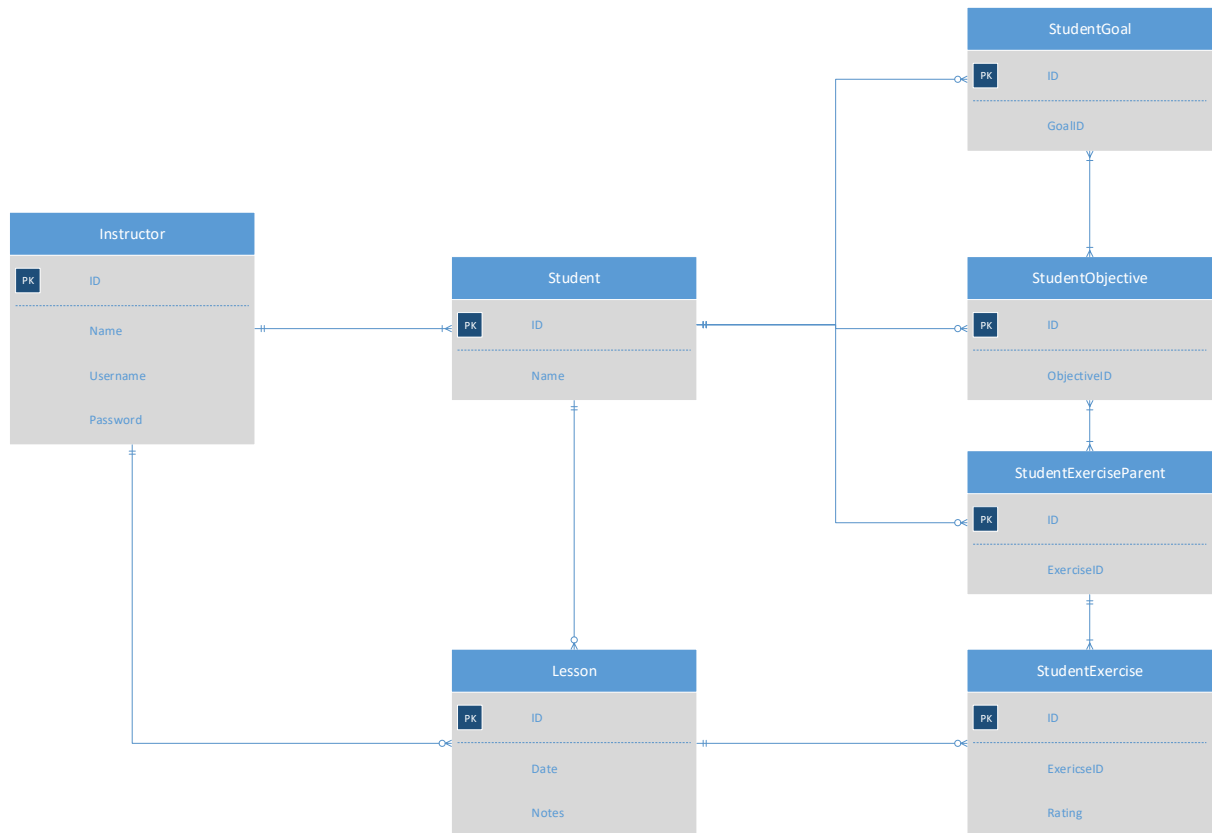
TrackingUP

Figure 5 Limited Entity Relationship Diagram for TrackingUP Application

Please note, the above Entity Relationship Diagram is limited for the purposes of legibility. For an extended diagram, please refer to **Appendix B Entity Relationship Diagram, Extended.**

The TrackingUP main application uses the information stored in the TrackingUP Library application and relates it to students and their lessons. This database is more complicated but can be split into several sections: people, lessons, and tracking.

There are two types of people registered in the database, instructors and students. A single instructor can be linked to many students and have several saved lessons. Each student is linked to exactly one instructor. It is the student data type that is used to encapsulate all other data.

Within the lessons section, there are two main datatypes: lessons and student exercises. A lesson has several fields that record the student, date, lesson type, instructor, volunteers, horse used, the instructor's notes, a rating, and a list of student exercises. As several users had the requirement of never giving a numerical grade to the students, these ratings are always represented on sliders and in stars, never as a number. This, combined with the student exercises, is used to calculate the overall lesson rating. To further demonstrate the lessons, see the **Activity 1: Instructor Enters a Lesson.**

The tracking category is comprised of student exercise parents, student objectives, and student goals. The student exercise parents take the ratings of the student exercises to pass on to student objectives and student goals. These ratings are used to track student progress towards goals. The table below provides a more detailed breakdown of these datatypes.

Table 3 TrackingUP Datatypes

Name	Description
Instructor	Instructors are the main user group of the application. They contain a list of students and lessons they taught.
Student	The student datatype stores all other information. This includes lessons they were in, their goals and objectives, and all student exercise parents. This datatype also saves information that instructors need to teach the student, such as any impairments they have or special notes.
Lesson	The lesson datatype is what links students to student exercises and instructors. The lessons contain written notes, pictures, videos, and a list of student exercises completing during that lesson.

Student Exercise	A student exercise is an instance of an exercise used in a specific lesson for a specific student. It contains a rating of how well the instructor believes the student performed that exercise in that lesson.
Student Exercise Parent	A student exercise parent contains all student exercises for that student that are linked to a specific exercise. For instance, it would store every time a student did the exercise "Airplane arms" since he started riding. Student exercise parents contain a rolling average of the ratings the student was awarding on that exercise.
Student Objective	A student objective is an instance of an objective linked to a specific student. It also contains a list of student exercise parents the instructor is using for the student to work towards that objective. Its rating is the average of all those student exercise parents.
Student Goal	A student goal is an instance of a goal linked to a specific student. It also contains a list of student objectives the instructor is using for the student to work towards that goal. Its rating is the average of all those student objectives.

Activity Analysis

To better convey the functionalities of TrackingUP, the two key scenarios are described below with accompanying screenshots. These two scenarios are an instructor entering a lesson into the system and an instructor checking student progress.
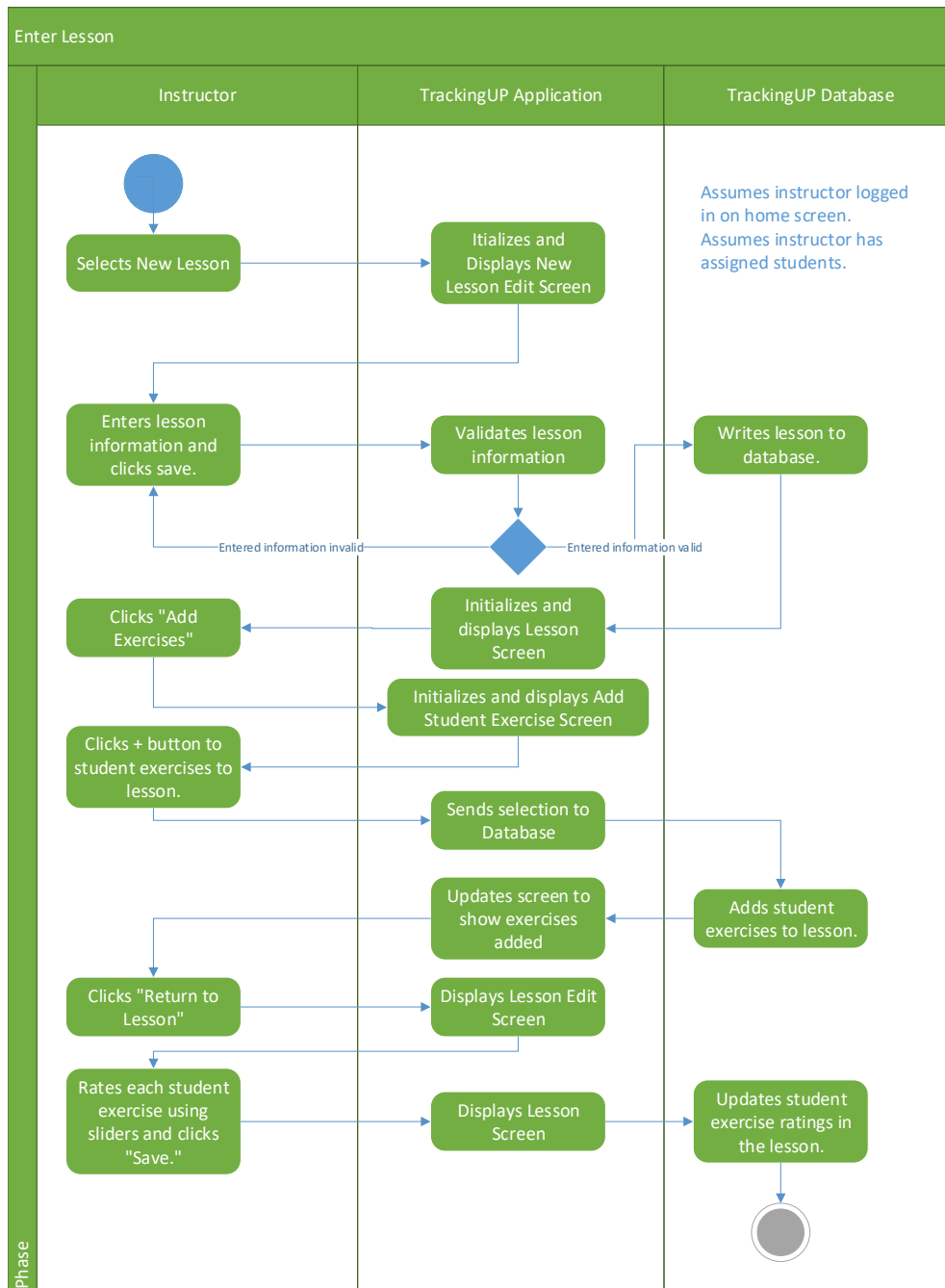
Figure 6 Activity Diagram for Entering Lessons in the TrackingUP Application

Activity 1: Instructor Enters a Lesson

The first activity analyzed is an instructor entering a lesson. This is the core of the application and the primary practice that was changed for the instructors. The following section walks through an instructor entering a lesson into the system.

The below screenshot displays a new lesson note. Here, the instructor will enter the basic information of the lesson including the date, their rating of how it went overall, and any free hand notes they have.

Figure 7 Lesson Edit Page with a Blank Lesson Screenshot

Once all the basic information has been entered and the lesson saved, the user can add student exercises to the lesson. This is what allows the system to track student progress.

By clicking the "Add Exercises" button on the lesson screen, the instructor is taken to a list of all exercises saved in the library. When an exercise is added to the lesson, a student exercise is created. This is a datatype separate from the exercises stored in the library, as discussed in **Database – TrackingUP**

Library. The student exercise variable stores the primary keys of the selected exercise, the student, the lesson, and a rating.

Once the student exercises are added to the lesson, the instructor can enter ratings for each, the below screenshot shows a lesson with an editable list of student exercises. By moving the sliders next to the exercise, the instructor can add a rating to it to say how well the student did in that exercise.

Figure 8 Lesson Edit Page with Student Exercises Screenshot

Once the rating is submitted, the student exercise is added to the relevant student exercise parent. For clarification purposes, the differences between the three types of exercise datatype have been placed in the below table.

Table 4 Exercise Datatypes

Name	Description
Exercise	An entry in the TrackingUP Library that describes an activity instructors can use in a lesson. Exercises are linked to objectives.

Student Exercise	An instance of an exercise that is used in a specific lesson and is linked to a student. Student exercises contain ratings.
Student Exercise Parent	A datatype that contains all student exercises linked to a specific exercise. Student exercise parents contain a rating gained from a rolling average of student exercises. It is student exercise parents that are linked to student objectives and track the student's progress in that exercise.

Once the student exercises are rated, the lesson note is complete and the lesson rating can be calculated. This is a weighted average of the exercise ratings and the instructor's overall lesson rating. The below screenshot shows the final screen of a saved lesson. The lesson module has additional features, such a photos and videos, discussed in the **Appendix C User Manual**.

Figure 9 Saved Lesson Page With Exercises and Ratings Screenshot

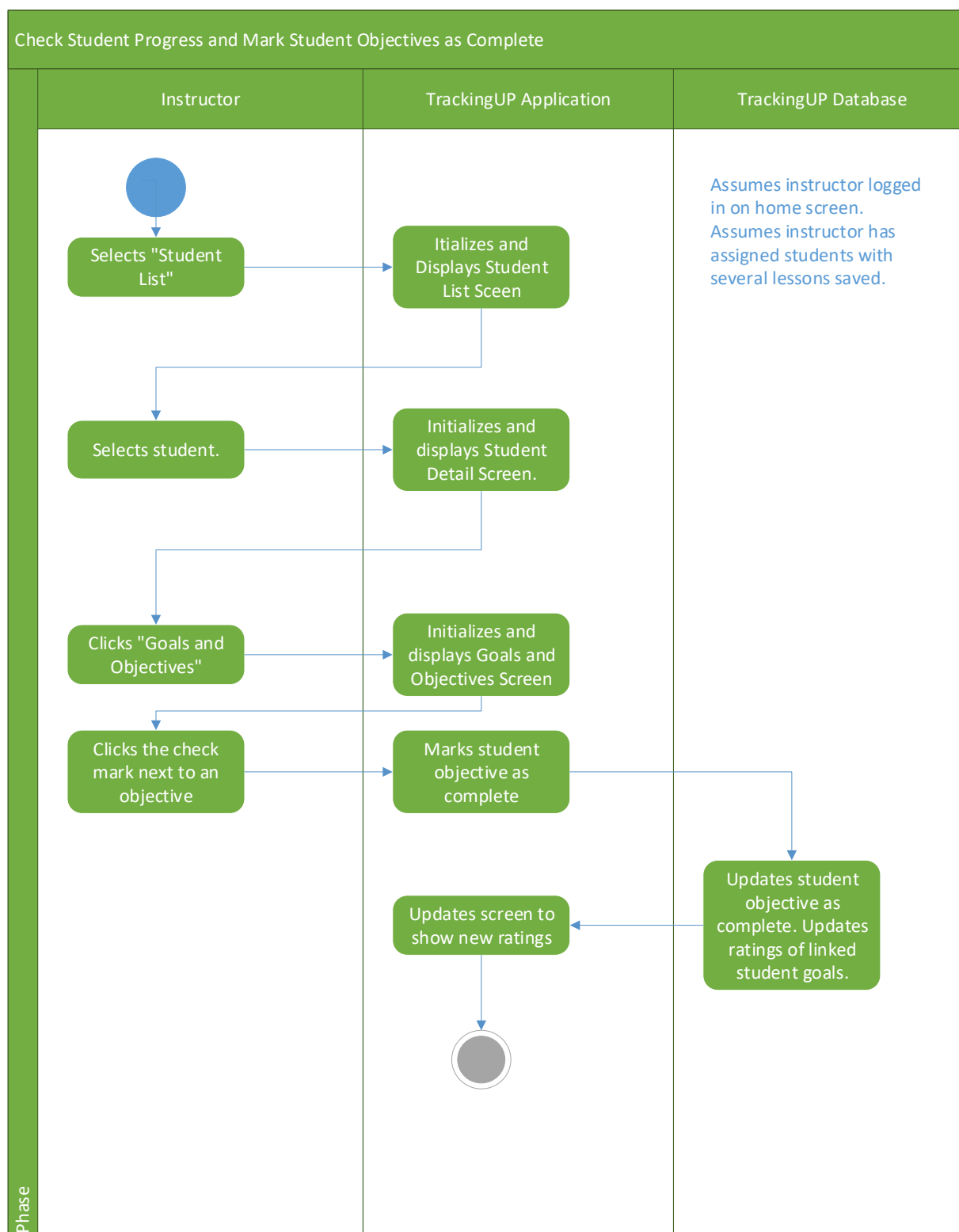**Activity 2: Checking Student Progress**

Figure 10 Activity Diagram for Checking Student Progress in the TrackingUP Application

Once several lessons have been entered, the instructor can view the student's progress towards their saved goals. The below section describes how an instructor can track student progress.

To view any information related to a student, the instructor must navigate to the student's information screen, pictured below. From this screen, the instructor can view all lesson notes for the student or view their goals and objectives.

Figure 11 Student Detail Screen for Model Student Screenshot

The instructor will be shown an expandable list with stars denoting a student's level of completeness or mastery of every goal, shown below. Instructors can also click the check mark next to each goal and objective to override the system's analysis and mark an objective as complete.
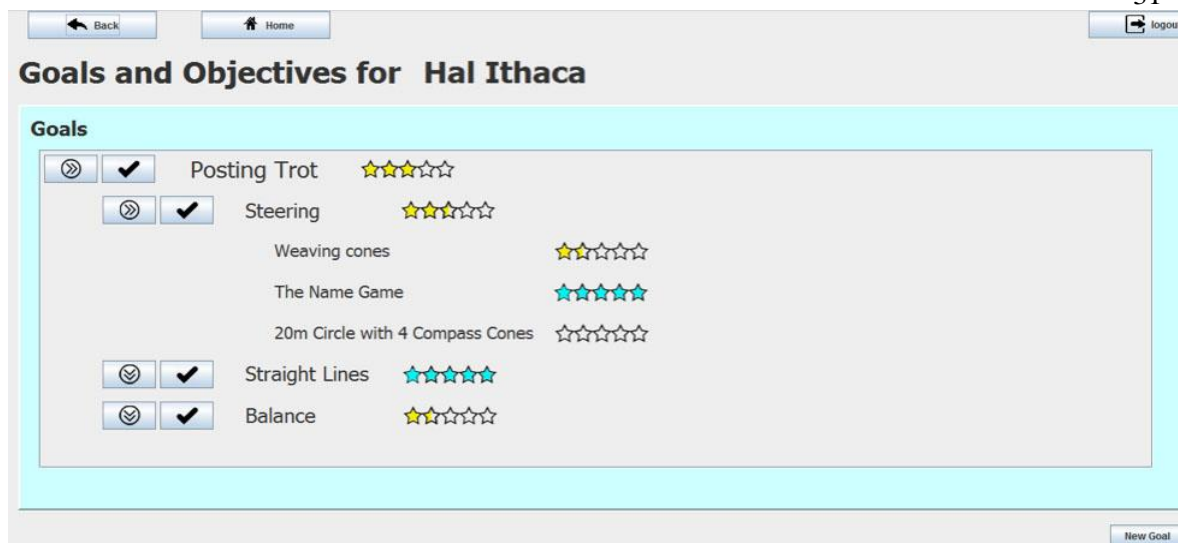
Figure 12 Student Progress Tracking Page Screenshot

Clicking on any student goal, student objective, or student exercise will show the progress in greater detail.
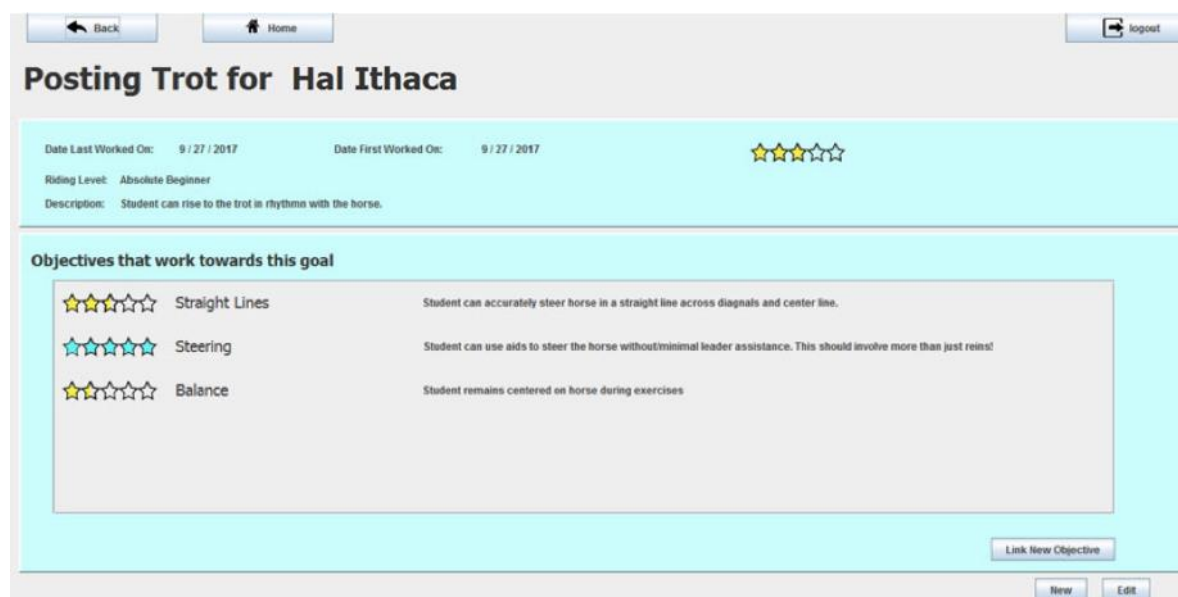

Figure 13 Student Goal Page for Model Student Screenshot

Chapter 3 Usability Study

A usability study was conducted in order to understand the viability of TrackingUP and its effects on therapeutic riding. This study involved two parts. First, the participants were given the application and trained in its use. They were encouraged to give feedback during this training session so that it functioned as a think aloud design session. Then, they used the application for a two month trial ending in a usability survey.

Population and Sample

A major complication in determining the appropriate sample for this trial was the varying nature of therapeutic riding facilities, conditions, and lesson types. As a result, more instructors were involved in the design of the system through interviews and focus groups than those that could trial it. This trial period uncovered new ways the application may be utilized or improved as well as demonstrating various existing impediments to adoption.

A group of seven instructors across three therapeutic riding facilities were selected to participate in the trial. These instructors were chosen based on the fact that each had a complete cohort of regular lessons with existing students within the trial time frame. As a result, each instructor had several years of experience within therapeutic riding and was familiar with running a long term therapy program with each of their students. Combined, these instructors had over fifty students with a minimum of eight regular lessons each throughout the months.

Data Collection

The usability study of the application was conducted over a two-month period. The trial could not take place over a longer time span due to weather and other constraints on the facilities. Participants were recruited at three therapeutic riding facilities, Hope Springs Equestrian Therapy, Thorncroft Equestrian Center, and LaSata Farms. At the beginning of the trial, participants were given the application and a user manual and taught in the use of the application. The first week consisted of brief "think aloud" usability testing sessions with each of the participants. If they encountered any usability flaws, they were encouraged to verbalize those flaws to be logged for future development.

Throughout the rest of the trial, participants logged all lessons within the application and used it to track student progress. As they used the application, a connected audit log program recorded how they used it. This program recorded each action in the form of "[Instructor ID] saved [lesson ID] with [student ID]. Using [number of exercises saved]." All ID values were randomly assigned by the program to prevent the loss of instructor or student confidentiality. Only instructors knew their own ID number. At the end of the trial, instructors were given a debriefing survey on which they wrote their ID number to be linked with the audit log data. These surveys were collected in hard copy to preserve that confidentiality. For more information on the audit log program and the survey, please see **Appendix A Collection Instruments**.

Chapter 4 Analysis of Results

The TrackingUP trial yielded insightful information into the users and their habits. It demonstrated different ways the users found to adapt the system, parts of the system that were underutilized, and parts that worked much better than expected. This section will build on the results of the survey to analyze the user experience with the overall application as well as avenues for potential growth.

Data Analysis

The main section of the survey comprised a System Usability Scale of 10 questions. System Usability Scales (SUS) are common tests designed to determine a computer system or application's usability after a trial period. They are comprised of 10 statements to which users rate their agreement 1-5. The statements alternate between positive and negative feedback. When the survey is processed, the scores are converted so that in each case a higher score represents positive feedback for the system. These scores are then converted to numbers from 1 to 100. The graph below demonstrates the grading of these scores. Generally, a score above 68 is considered above average. (Affairs, 2018)
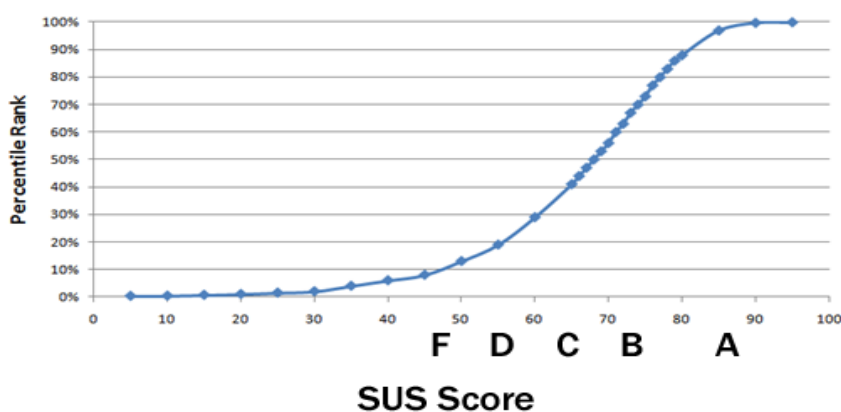

Figure 14 System Usability Scale Score Trends with comparable letter grades. (Sauro, 2011)

Once the surveys were collected, the first ten questions were analyzed using a System Usability Scale. After taking the average across all survey results, the computed score for TrackingUP was 80.5. This score is exceptionally high for system usability scores, indicating a high level of user acceptance of the system. This was significantly higher than expected given the low level of technology adoption within the domain, indicating the user population is far less resistant than previously assumed.

Looking deeper into the survey results provides a little more clarity into the user experience. For instance, four questions were tied for the highest score of 3.6 out of 4. These were questions 4, 6, 7, and 10. These questions asked the user to rate their agreement with the following statements: "I think that I would need the support of a technical person to be able to use this system", "TrackingUP helped me create a systematic method to track students' progress", "I would imagine that most people would learn to use this system very quickly", and "I needed to learn a lot of things before I could get going with this system" respectively. Again, a high score after processing indicates a positive result for TrackingUP, regardless of whether the statement was original negative. Each of these questions relates to the ease with which users adapted to the system and whether the user felt they needed technical assistance with the program. This is corroborated by the fact that throughout the trial the investigator was never called upon to provide technical assistance after the demonstration provided at the beginning of the trial. The lowest score, 1.8, was on question 3. Question 3 asked users to rate how the application helped them plan student lessons. The low score on this indicates that instructors did not find the lesson planning methods of the note taking application intuitive. This can be addressed in later versions of TrackingUP. For the full text of the questions, please see **Appendix A Collection Instruments**.

The survey contained open ended question in addition to the system usability scale. In these, users provided more detailed feedback in how they used the system. Several included in their survey a list of additional features they would like in the next release of the application while others wrote notes on how to properly implement it throughout their entire facility.

Discussion of Overall User Experience

Overall user feedback was overwhelmingly positive with instructors asking to keep the application to use for note keeping past the end date of the trial. The application proved intuitive to use after a brief introductory session. During the trial, no instructors had to request additional assistance or training in the use of the application. No fatal errors occurred and all data was easily migrated at the end of the trial.

Most instructors agreed that the application provided a better way to track student progress and organize notes. Several instructors stated the system made them take more detailed notes of their lessons than if they had been writing a paragraph by hand. They found that the prompts within the lesson note module made them more focused on the activities and student progress within the lesson which guided them to more streamlined notes. They also found that having all the student notes in one place made it easier for them to act as substitute instructors for one another.

However, the success was not unqualified. Several participants had issues when first adapting to using a computer from paper-based notes while others felt the system was overly cumbersome or complex. An important note was often added to this portion in the surveys—users found the TrackingUP library portion overly complex as it forced the "goal, objective, exercise" mentality onto their lessons in a manner sometimes detrimental to the lesson flow. In contrast, most stated that the core of the application—the lesson note module—was relatively straightforward.

Several instructors found unexpected and innovative ways to use the application. For instance, one instructor wanted to track a student's hearing loss over time and designed a new way through the system. To do this, she planned to save "hearing" as a goal and objective. Then, in each lesson she would save the student's "hearing" as an exercise with a rating showing how much of the lesson he was able to hear. This way, the system could show his hearing over time to provide a more accurate progression of his hearing loss. She could then provide this data to his caregivers to improve his medical treatment. Another

instructor tracked a student's overall progress through the lesson ratings on the student list while her barn manager tracked instructor progress by viewing the lesson ratings over time linked to each instructor. This way the instructor not only saw progress towards specific goals, but also social progress of the student himself. Should the system be rolled out further, more innovative users and adaptations are expected in the future.

Improvement Opportunities

While overall feedback of TrackingUP was positive, it contained many of possible avenues for future improvements. The most common suggestions are included below with analysis of their feasibility.

Additional Data Analysis Features

Several instructors expressed a desire for more data analysis than just progress towards a goal. They wanted monthly reports that would capture the progress made in that month and what they had worked on the most. These, they argued, would provide more balanced care as it would provide insight into the frequency with which they work on each goal. A possible design for this is a line graph sketched onto the back of a survey, that charts student progress over time, recreated below.
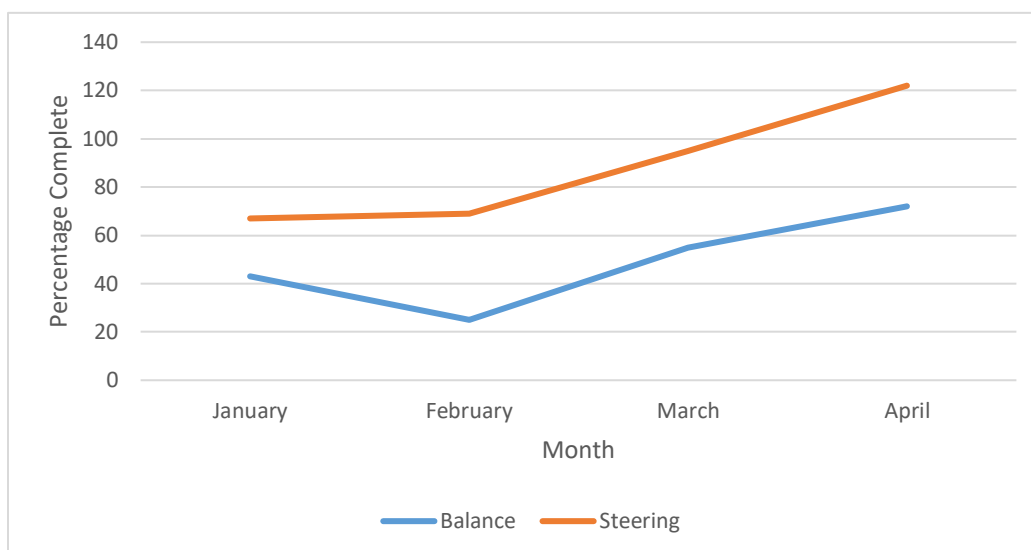
Figure 15 Example Graph of Student Progress Towards Objectives Recreated from Survey Response

This addition would be possible to add to the next release of TrackingUP as it is just an additional analysis of data already collected. In order to be useful, these charts would also need a print option that allows the instructor to print a regular report to store with hard copies of lesson notes.

Templates

Since the lowest score on the survey was given to the ability of the application to help plan lessons, another improvement would be in helping instructors find the lesson planning portion. In the current release, it is combined with the note taking module as a secondary function. This can be done in several ways, but the easiest on the user would be lesson templates. An extra button in the home screen could take the user to a new screen that guides them in creating a lesson template, or list of exercises. Then when an instructor comes to write notes on a lesson, they can import the exercises from the template. This way the instructor can have several lessons already planned out to make note keeping easier, but also encourage proper lesson planning. This would have the additional benefit of helping substitute instructors as they can see the type of lessons that the student is used to. While useful, however,

the templates must remain flexible. An instructor must be able to use a template for a lesson note without losing the ability to add or remove exercises from that specific lesson.

Lesson Goals

One of the most repeated recommendations was lesson goals. These would be unlike the long-term goals as they are focused on a specific lesson. If instructors adopt the use of the application for lesson planning, they can also state what each lesson template works towards. That way, they are entering each lesson with a goal in mind as well as a prepared list of exercises. Additionally, having a goal associated with each lesson note will help the instructor when developing an accurate lesson rating. Just as with the exercises, these goals must be flexible—an instructor could have one goal in mind but end up working on something else entirely with the student, depending on the circumstances.

Chapter 5 Conclusions

The results of the survey lead back to the beginning with the three research questions that started the study.

1. What are the barriers to instructors adopting computer applications in support of therapeutic riding programs?

2. Will defining and tracking riding objectives through a computer application change the way instructors plan or track lessons? Why or why not?

3. What are some general design principles for applications to support therapeutic riding?

Question 1

As previously mentioned, the domain of therapeutic riding is notoriously technology resistant. While some users have a technical background, almost all lesson notes are maintained in a paper-based system out of preference and familiarity. For this reason, few barns have tried adapting computerized note taking programs, and even fewer developers have attempted to create applications for this niche market. However, after a relatively short trial, many instructors expressed a wish to keep using the TrackingUP system. What started as a group of people resistant to technology in all forms, turned into a cohort of computer advocates redesigning systems and implementing them in ways not previously imagined.

This opens an interesting debate. The instructors started out as resistant to technology as expected. After a few weeks they turned out to be far more willing to adopt technology than previously imagined. In fact, they embraced the technology with neither limitation nor barrier. While the therapeutic riding profession as a whole has very little technology integration, this is not wholly due to the community's inability to adopt technology, but rather a lack of exposure. During the domain analysis of this project, no similar applications in the market or studies of technology use in therapeutic riding were

located. Therefore, the primary barrier to adoption is a simple lack of available technology *to* adopt. The second barrier may still be change resistance in the profession as the participants initially resisted the idea of "needing a computer to do my job." However, barring a single hold out, that resistance quickly faded into the excitement of a new system to explore.

Question 2

In the post-trial survey, one respondent wrote "My notes were much more comprehensive than my manual notes and more focused." She goes on to describe how the program helped her stay on task with the student's goals and objectives as it provided her with constant live feedback. In the System Usability Scale, the question that asked if TrackingUP helped instructors create a systematic method to track student progress scored a 3.6 out of 4, the highest score across all questions. In this way, the surveys indicate that the TrackingUP system successfully changed the way instructors tracked lessons and student progress.

While the system changed the way instructors tracked lessons, the low score of 1.8 out of 4 indicates this was not the case for planning lessons. This leads to an odd contradiction. The application clearly impacted the way instructors record lessons and track student progress. This constant consciousness of long-term goals can be assumed to impact the lessons in a beneficial way, however the application did not then help instructors plan lessons. This negative response does not mean that the lesson planning was not affected, but simply that instructors did not consciously change the way they planned out lessons for their students. This means that the answer to the question is, if anything, a qualified yes. Yes, defining and tracking riding objectives changed the way instructors tracked lessons. And yes, it probably had an impact on the lessons as it provided instructors with extra knowledge when conducting a lesson. But, according to the survey, it did not change the way instructors planned lessons.

This question can be explored in further research with an application more focused on lesson planning, including the templates recommended in **Improvement Opportunities.**

Question 3

As question 1 indicated, the therapeutic riding profession is comprised of people who, while initially resistant to technology, will willingly embrace a system that makes sense to them. The study affirmed the design principles already established in the domain analysis portion of this project. The post-trial survey also demonstrated which principles are most important and revealed additional, necessary features.

As the large amount of innovative adaptions instructors made to the system—from tracking instructor progress in parallel to student progress to monitoring progressive symptoms within students—demonstrates, the system must have a wide range of adaptability. Just as in most therapy industries, students vary significantly from lesson to lesson and a system that forces instructors to always behave the same way will never work in such an profession.

The system must also be dependable with report printing. One of the suggested improvements on the survey was the use of a backup system. One of the instructors wrote on her survey that she maintained hand written notes in parallel to those she saved in the system for fear the computer would crash. Most instructors printed out the computer generated report for each lesson to store in place of the hand-written notes. These lesson reports, in addition to the monthly progress reports suggested in **Improvement Opportunities,** prove that such a function is vital in all future applications within the field.

Finally, the system must be customizable. Every instructor has a different method for note keeping. Some want to record everything that happened in a lesson, while others are only interested in new events or a break through. Some believe in rating a lesson as a whole while others believe rating an entire lesson adds too much pressure. As the audit logs of the trial demonstrate, each instructor had a

totally different method of note keeping. Some set up a lesson with exercises the day before, others never added exercises to the lesson unless there was a significant achievement or regression. Some wrote their lesson notes immediately after the lesson while others would wait several days before recording what happened. This large level of variance demonstrates the absolute need for customizability. In a field so unfamiliar with technology, any new system must appear as easy and familiar as possible. The system must allow the instructor to take her notes the way she wants to, and not force alien practices onto her. Later down the road, when technology has become familiar to the field, more enforceable standardization can be brought in. At this present stage, however, that would be nothing but counterproductive as users will resist any attempts to enforce behaviors on them. As the current challenge is to introduce users to computerized note keeping and make them as comfortable as possible with the concept, creating additional barriers will make future progress that much harder.

Future Work

The above study demonstrated the potential adoption and effective use of the TrackingUP system. However, it operated under certain limitations. To properly view how TrackingUP changed instructor practices beyond simple note taking and how student progress was impacted, the researcher would have to view the lessons themselves and student data over time. Viewing this data was not possible due to HIPAA regulations protecting the student medical information. Future studies could analyze the impact of similar application on the entire practice of therapeutic riding, from lesson planning through to student progression.

Additionally, future research could gather a more extensive sample, testing the application across more barns and using more instructors. This would lead to more accurate data on adoption levels and possible uses for the application. It would have the added benefit of getting more instructors used to the

concept of using technology in their day-to-day job, making total adoption of future technologies more feasible.

As one of the instructors noted in the survey that she wanted to explore more uses of the application but did not have time during the trial, future studies should consider taking place over a longer period of time, such as a year. As student health varies with the seasons—such as winter being hard on those with arthritis—it would be beneficial to instructors to see how the student progress rate varies over time, especially if a new feature of the application is the monitoring of symptoms, as one of the instructors demonstrated. This would also gain insight into if the system can be consistently used over a longer period of time, and if so how.

As for the TrackingUP application itself, the post-trial surveys revealed many avenues for future improvement both by fine tuning existing features and adding new ones. While the application began as a proof of concept, the trial revealed a real need for a standardized note taking application within the profession. As such, several of the barns involved in the study have requested to keep the system for continued use. To facilitate their processes, the TrackingUP system will be improved upon. These improvements will take recommendations from the surveys, requests from the barns, and insights gained from the audit logs. For instance, the lesson planning features will be emphasized within navigation and a module for the printing of monthly reports will be created.

Conclusion

Overall, the results of the study were promising. The initial hypothesis proved too conservative with regards to user acceptance as each user adapted to the application and responded well to its design in surveys. Initially, the technological inexperience of the users was expected to be the greatest barrier to adoption of any computer application in the field, but the TrackingUP trial demonstrated that this was not

the case. The study demonstrated that if an application is intuitive enough and does not over complicate everyday tasks, even the most reluctant user can learn to rely on it. Instead, the greatest barrier is simply awareness. Technology is so absent in the field of therapeutic riding that users simply do not know where to look to find and utilize such applications, even if they want to. The study established design principles that are needed for the therapeutic riding field—namely customizability of an application and an intuitive interface. Regarding changes in instructor behavior, further studies will have to be completed analyzing user lessons and how they change over time. However, anecdotal evidence collected through the surveys and audit logs demonstrate that instructors saw their note keeping behavior change to become more detailed an efficient. They also found the new insight into each student's progress towards goals altered their decision making. In conclusion, the TrackingUP application proved to be a success and opened up many potential avenues for future research.

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Appendix A

Collection Instruments

Audit Log

Each time a Save" button is clicked, the program writes to AuditLog.txt in the following format:

Date: mm/dd/yyyy hh:mm:ss

User: [username] saved a [data type that was saved e.g. Lesson].

This [data type] was created on: mm/dd/yyyy hh:mm:ss.

End of Trial Survey

At the end of the trial, participants were given the below System Usability Survey. At each question of the first ten questions, they were given a scale of 1 to 10 to rate their agreement with each statement.

1. I think that I would like to use this system frequently.

2. I found the system unnecessarily complex.

3. The system helped in planning student lessons.

4. I think that I would need the support of a technical person to be able to use this system.

5. I found this system useful in tracking student progress and/or keeping lesson notes.

6. TrackingUP helped me create a systematic method to track students' progress.

7. I would imagine that most people would learn to use this system very quickly.

8. I found the system very cumbersome to use.

9. I felt very confident using the system.

10. I needed to learn a lot of things before I could get going with this system.

Do you feel this could be an improvement to your current method of record keeping? If not, why not?

Any additional comments:

Appendix B

Entity Relationship Diagrams, Extended

Due to the complex nature of the data involved, a complete entity relationship diagram could not be included in the original section. As such, please find more detailed diagrams below. For the sake of legibility, they have been broken into sections for expanded view.

TrackingUP Library Database
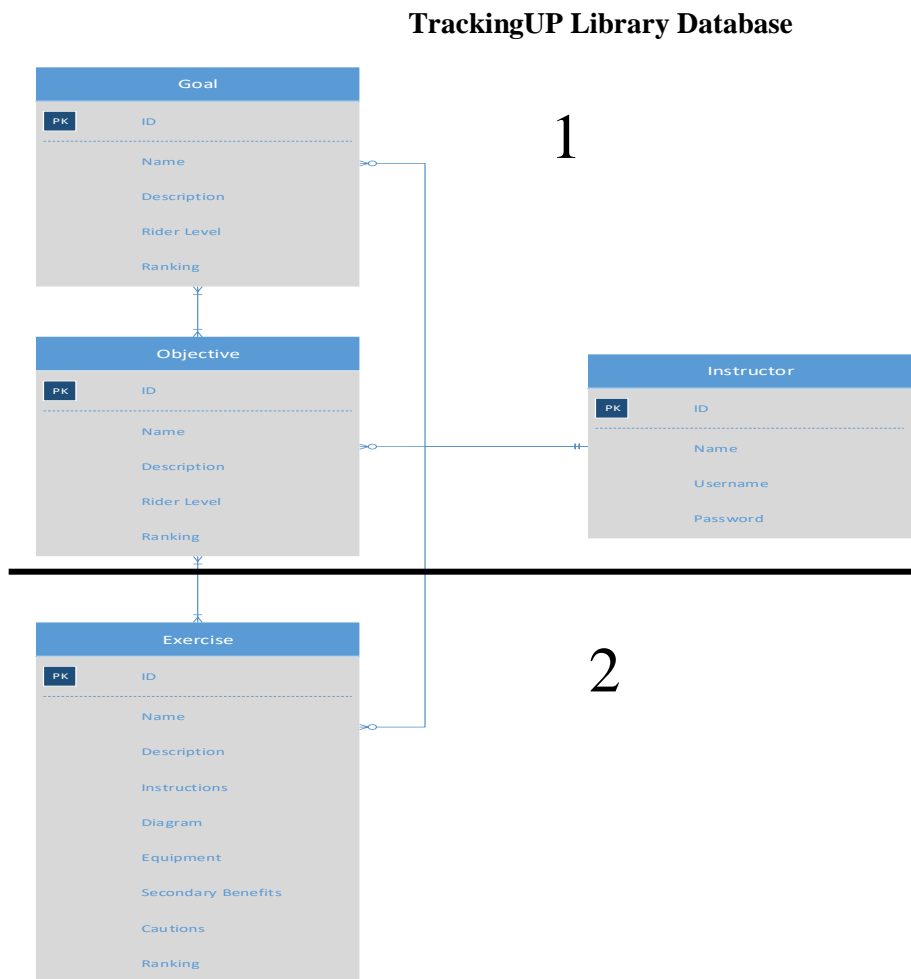
Figure 16 Extended Entity Relationship Diagram for TrackingUP Library Database

1
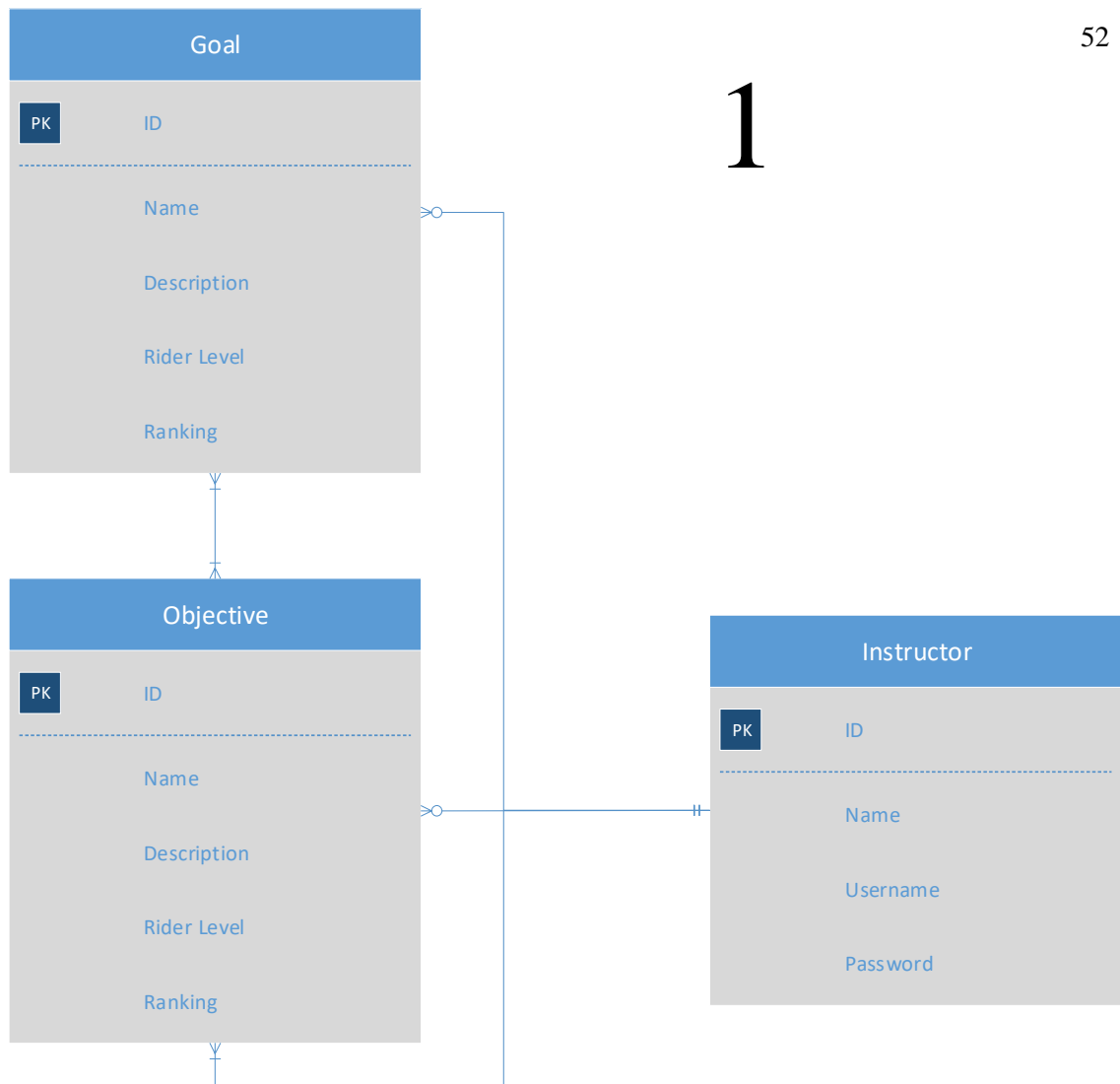
Figure 17 Top Half of Extended Entity Relationship Diagram for TrackingUP Library Database

Exercise	
PK	ID
	Name
	Description
	Instructions
	Diagram
	Equipment
	Secondary Benefits
	Cautions
	Ranking

2
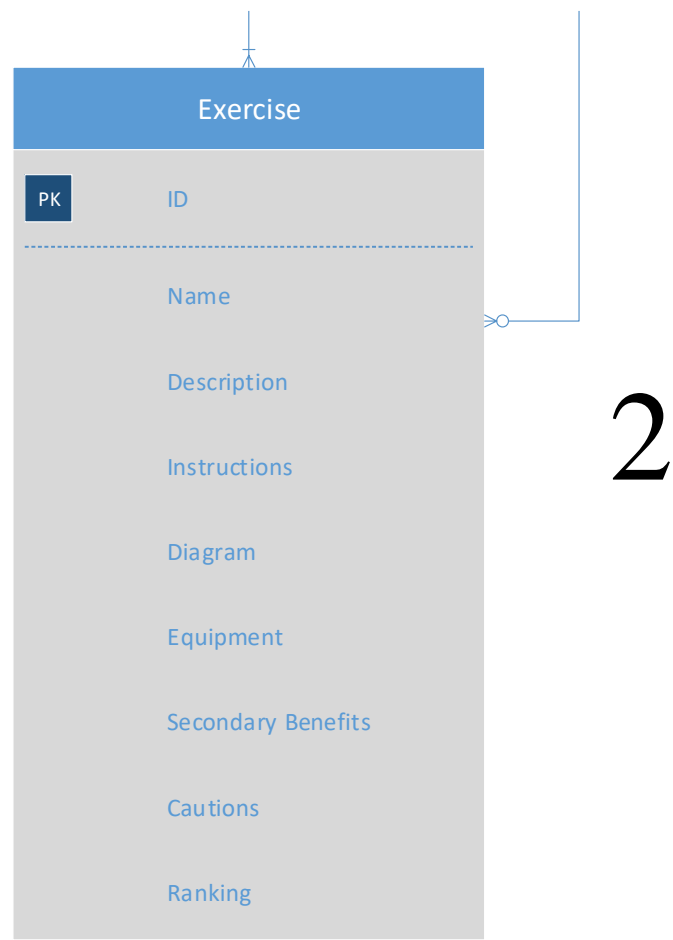
Figure 18 Bottom Half of Extended Entity Relationship Diagram for TrackingUP Library Database

TrackingUP Database

Student

PK	ID
	Name
	attribute name
	Riding Level
	Date of Birth
	Height
	Weightt
	Gender
	Volunteers
	attribute name
	Prefered Horse
	Tack
	Mounting Instructions
	Rider Level
	Notes
	Walking Level
	Allergies
	Therapeutic Category
	Onset of Condition
	Additional Medical Information
	Cautions

Instructor

PK	ID
	Name
	Username
	Password

Lesson

PK	ID
	Date
	Lesson Type
	Volunteers
	Horse
	Notes
	Instrutor Rating
	Lesson Rating
	Videos
	Photos

StudentGoal

PK	ID
	GoalID
	Date First Worked On
	Date Last Worked On
	Boolean Completed
	Date Completed
	Rating

StudentObjective

PK	ID
	ObjectiveID
	Date First Worked On
	Date Last Worked On
	Completed Boolean
	Date Completed
	Rating

StudentExerciseParent

PK	ID
	ExerciseID
	Date First Used
	Date Last Used
	Average Rating

StudentExercise

PK	ID
	ExericseID
	Rating

1

2

Figure 19 Extended Entity Relationship Diagram for TrackingUP Database

1

Instructor

PK	
	ID
	Name
	Username
	Password

Student

PK	
	ID
	Name
	Mounting Instructions
	Riding Level
	Date of Birth
	Height
	Weight
	Gender
	Volunteers
	attribute name
	Prefered Horse
	Tack

StudentObjective

PK	
	ID
	ObjectiveID
	Date First Worked On
	Date Last Worked On

StudentGoal

PK	
	ID
	GoalID
	Date First Worked On
	Date Last Worked On
	Boolean Completed
	Date Completed
	Rating
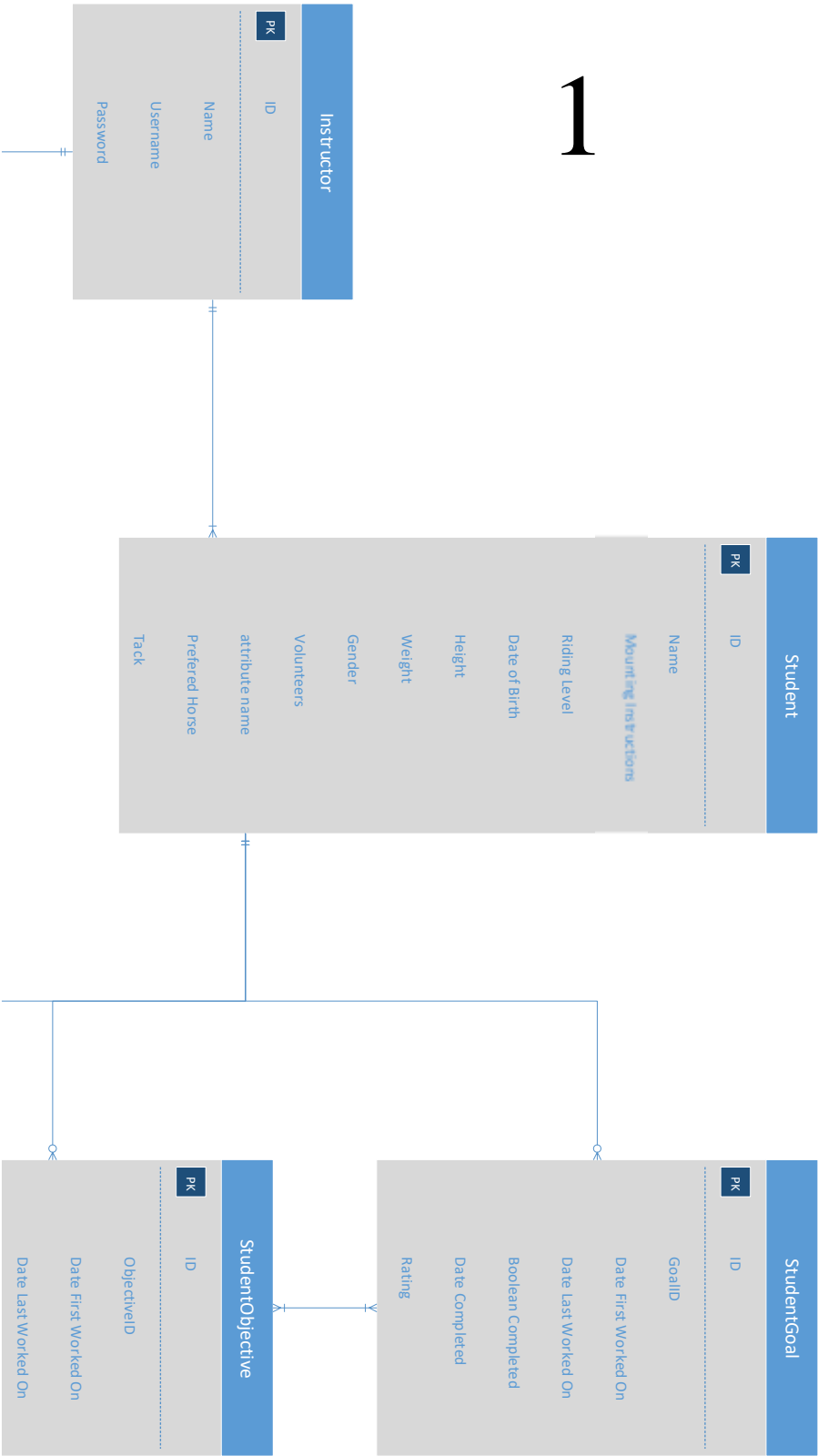
Figure 20 Top Half of Extended Entity Relationship Diagram for TrackingUP Database

2

Lesson

PK	ID
	Date
	Lesson Type
	Volunteers
	Horse
	Notes
	Instrutor Rating
	Lesson Rating
	Videos
	Photos

	Cautions
	Additional Medical Information
	Onset of Condition
	Therapeutic Category
	Allergies
	Walking Level
	Notes

StudentExercise

PK	ID
	ExerciseID
	Rating

StudentExerciseParent

PK	ID
	ExerciseID
	Date First Used
	Date Last Used
	Average Rating

	Completed Boolean
	Date Completed
	Rating
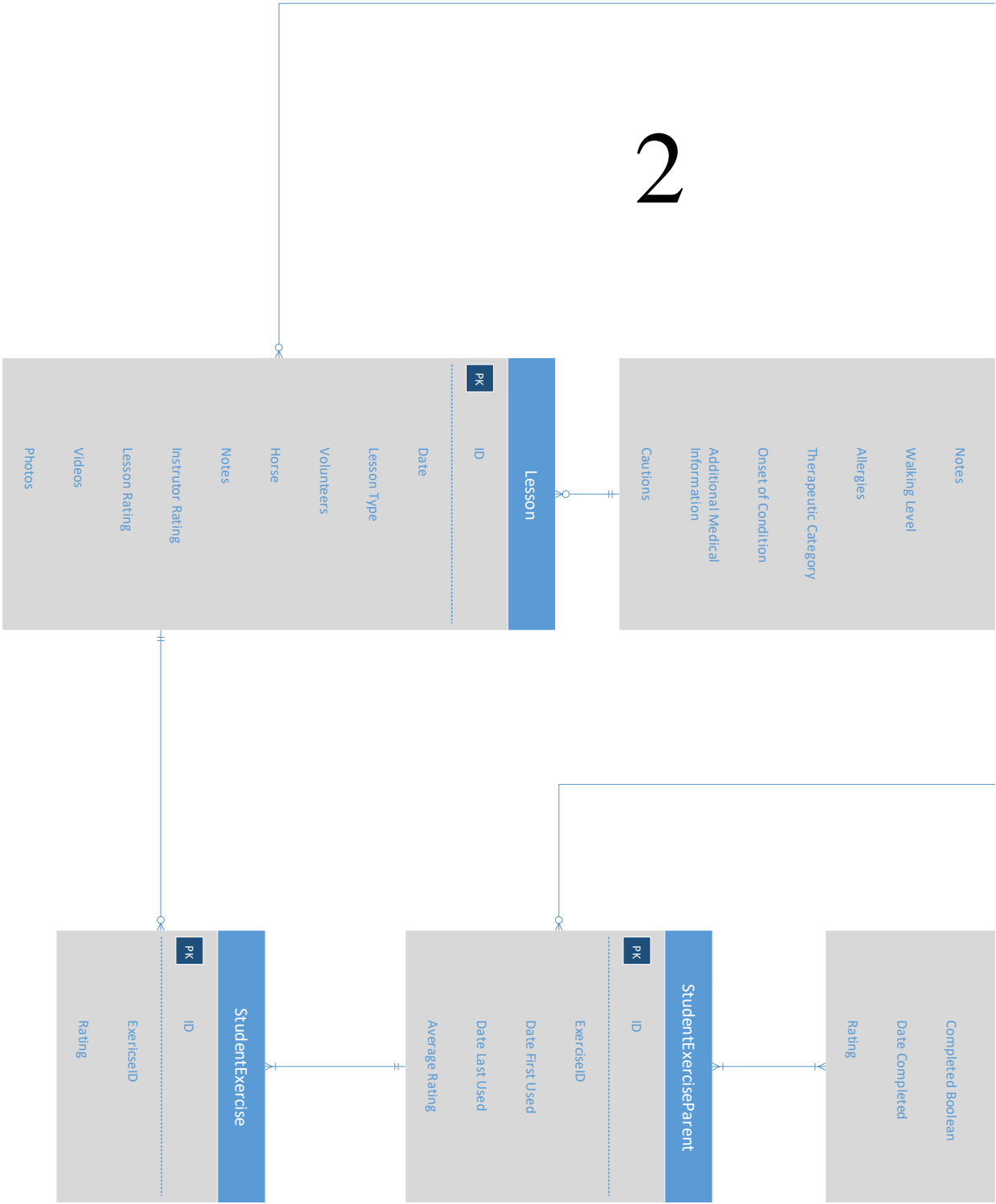
Figure 21 Bottom Half of Extended Entity Relationship Diagram for TrackingUP Database

Appendix C

TackingUP User Manual

The below user manual was distributed to trial participants at the start of the trial. It was printed in a spiral bound book with room for users to write comments and take notes.

Getting Started

This section will help you get set up on TrackingUP by creating your account and adding your students.

Logging In

When you first get started with TrackingUP, your username will be your first name capitalized and your password will be "password." So, if your name is Hannah, it would look like this:

Username: Hannah

Password: password

Home Screen

This is the screen you will be taken to when you first log into TrackingUP and the screen you will use to get to all the different parts of the system.

TrackingUP has two main modules. You can see them here denoted in different colors. These modules are the Exercise Library and the Student Notes Application. Throughout the application, the screens are color coded to help you keep track of which section you are in. The Exercise Library is in fuchsia while Student Notes are in blue.

To view any part of the application, click the button with the name.
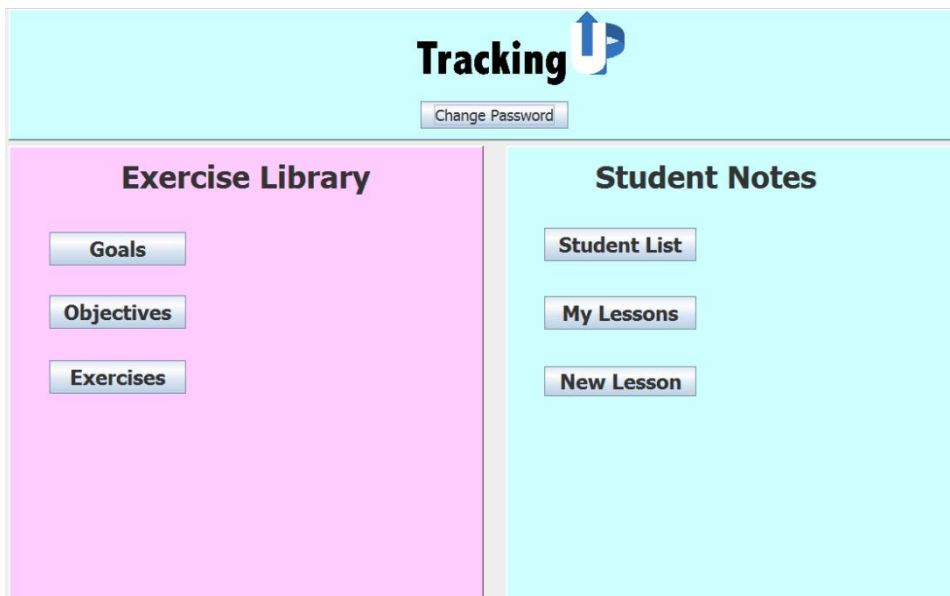
Figure 22 Home Screen

Changing Your Password

When you get started, the first thing you will want to do is change your password.
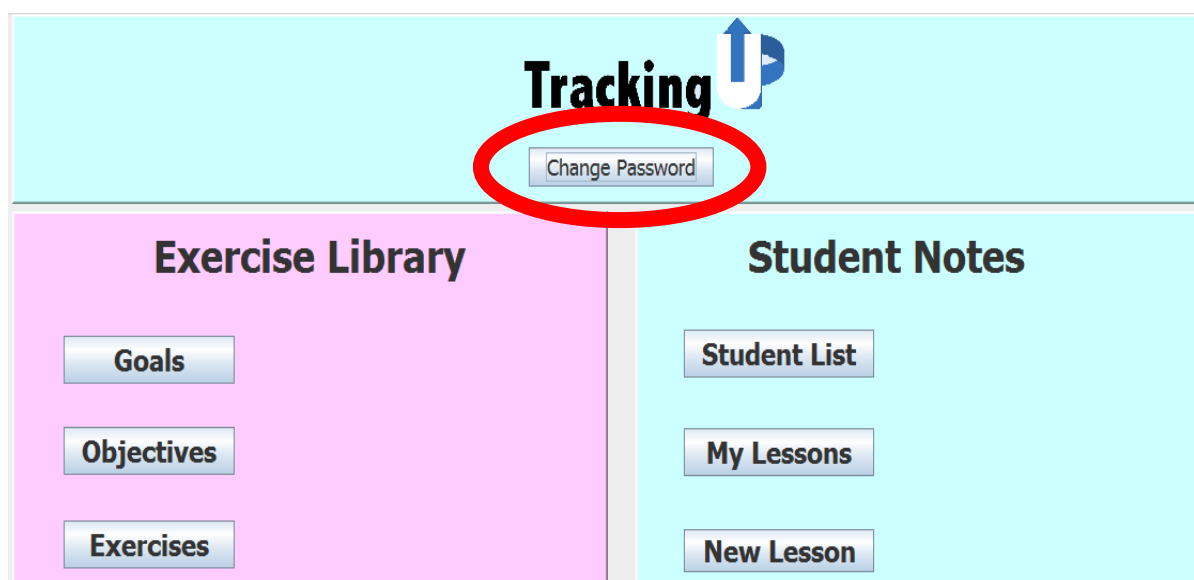
Figure 23 Home Screen, Change Password Highlighted

Click the "Change Password" button at the top of the home screen.

This will take you to the Change Password screen. In this screen, enter your existing password and your new password. Your new password must be at least eight characters long with at least one number.

Click the "Change Password" button underneath your new password and you're done!

Entering a Student

Now that you have your account set up, you need to create a student.

From the home screen, click the "Student List" button on the right. This will take you to a list of all students in the system. At the bottom right of the screen, click the "New Student" button. The next screen has a lot of information, so please take time to read the following section in detail.

For this trial, we will not enter anything in the Medical Information panel.

The first piece of information to enter is the student's name. This is at the top of the screen. Feel free to just use the first name, nickname, or a number, it just needs to be identifiable for you.

Next is the general information panel at the top left. This panel is very self-explanatory. For instance, Mount/Dismount is instructions for other instructors such as if the student needs a ramp or winch. Riding level can be "Absolute Beginner," "Beginner," "Intermediate," and "Advanced."

Figure 25 General Information Panel

The next section is riding information. This will be the most helpful to a substitute who has to take on your student. For each of the sections, you can select multiple options. You can also leave this section blank if you wish. See below for further explanations.

Figure 26 Riding Information Panel

- "Walks" describes how the student walks most of the time and what assistance they need. If your student has episodic problems with walking, feel free to select multiple options.

- Allergies is a text box where you can type any allergies the student has that you are aware of.

- Therapeutic Category gives possible reasons the student is engaged in therapeutic riding to help other instructors. Again, you may leave any section on this page blank.

- Onset of Condition denotes the time in the student's life that the condition began. If you are uncertain, you can select multiple options, leave the section blank, or write in the "other" section.

- Additional Medical Information includes any additional information that may be needed with this student. What goes into this section is entirely your choice.

- Cautions are anything that instructors should be aware of. This includes if the student is limited to walk only, leans a particular direction, or has triggers any instructors or volunteers need to be aware of. If you need more space, you can note additional cautions in the next section.

Figure 27 Student Edit Page

The third and final section we will be using is Notes. This is the most important section and the one that has the most freedom. This is a simple text box at the bottom of the page that allows you to write anything else you would want others to know about your student. Or anything that you think is important to remember. For the purposes of the trial, we will not be using the Medical Information section. Once you have entered everything, click "Save" at the bottom.

Lessons

This section will tell you how to create, view, edit, and delete lessons. This is the only section you will need to use every day.

New Lesson

There are several ways to create a new lesson. The quickest is to click the "New Lesson" button on the home screen. This will take you to the new lesson screen with a blank lesson. What you fill out in this screen is entirely up to you.

There are a few things that every lesson note is required to have. These are covered in this section. The below figure shows a new lesson. It will have your last student selected in the drop down at the top and the horse and volunteer textboxes will be prepopulated with the information from the last lesson you had with this student.

Figure 28 New Lesson Screen

The only required fields are "Lesson with:" and "Notes." The "Lesson With" drop down at the top is where you select the student. Simply click the drop down and select your student's name from the list.

On the right had side of the screen, there is the "Notes" section. Just type your lesson notes in the white box. These should be whatever you would normally write about the lesson.

At the top of the screen, there is a short blue panel that shows the basic information about the lesson. The most important is the slider at the top right. This is your subjective idea of how well the lesson went. The further right you move the slider, the better the lesson was.

Figure 29 Lesson Information Panel

When you are done, click the save button at the bottom right. Once you have saved a lesson, you will see the lesson screen below. Nothing can be edited from this screen. To edit any of your notes or information, click the "Edit" button at the bottom of the screen.

Figure 30 Saved Lesson Screen

The above section walked through creating a basic lesson note, but that note did not include exercises and could not contribute to the system tracking your student's progress towards goals. Listing exercises in the lesson with this functionality will allow the program to track your student's progress towards goals. Using the tracking functionality will be explained in a later chapter, but for now you need to know how to add exercises to a lesson.

Figure 31 Saved Lesson, Add Exercise Highlighted

Once you have saved a lesson, you will see this lesson screen. You will notice the stars at the top of the screen.

To add exercises, click the "Add Exercise" button on the left-hand side of the screen. This will take you to a list of all exercises saved to the system. Once you have saved a few lessons into the system, it will be able to organize this list better. The exercises you use with the student most frequently will be at the top of the list. If you click on the "Objective" button at the top of the screen, it will sort the exercises based on those the system recommends for your student. The system takes in all the information entered on your student including riding level, cautions, and goals and uses that to determine the best exercises based on what you and other instructors use most frequently in similar situations.

Figure 32 Add Exercise to Lesson Screen

When you are adding anything in this system, click the + sign next to it. So to add an exercise to your lesson, click the + sign next to it. When it is added, the exercise will change green and the button will change from a + sign to a trash can. Click this to remove the exercise from the lesson. The links automatically save when they are added or removed, so you do not have to do anything else.

When you are done, click the "Return to Lesson" button at the bottom of the screen. This will take you back to the lesson edit screen. This should have all the information you entered previously as well as the exercises you just added on the left. Next to each exercise is another trashcan button and a slider. The trashcan button deletes the exercise from the lesson. The slider allows you to say how well the exercise went in the lesson. As with the slider at the top of the screen, the further right you move it, the better you think the exercise went.

Once you have moved the sliders to the right position, click the "Save" button at the bottom of the screen and save your lesson.

Figure 33 Lesson Edit Screen with Exercises

This will take you to the final lesson screen. You'll notice all the star values. These are taken from what you enter with the sliders. Looking at the top three stars:

- Lesson Rating is the weighted average of your ratings for all the exercises and your overall feel for the lesson. If you do not move the sliders on the exercises, the application will only use your overall rating of the lesson.

- Average Exercise Rating is the average of all the ratings you give to each exercise.

- Instructor's Lesson Rating is the rating that you gave the lesson overall. This is independent of the exercises.

Figure 35 Final Lesson Screen

One of the advantages to keeping notes on a computer is you can add pictures. To do this, click the "View Pictures" Button on the lesson screen.

This will take you to a screen that contains all the pictures linked to the lesson. To add another picture, click the "Add picture" button. This will open a windows explorer window. This is the same as you would use if you were posting a picture to FaceBook or attaching it to an email.
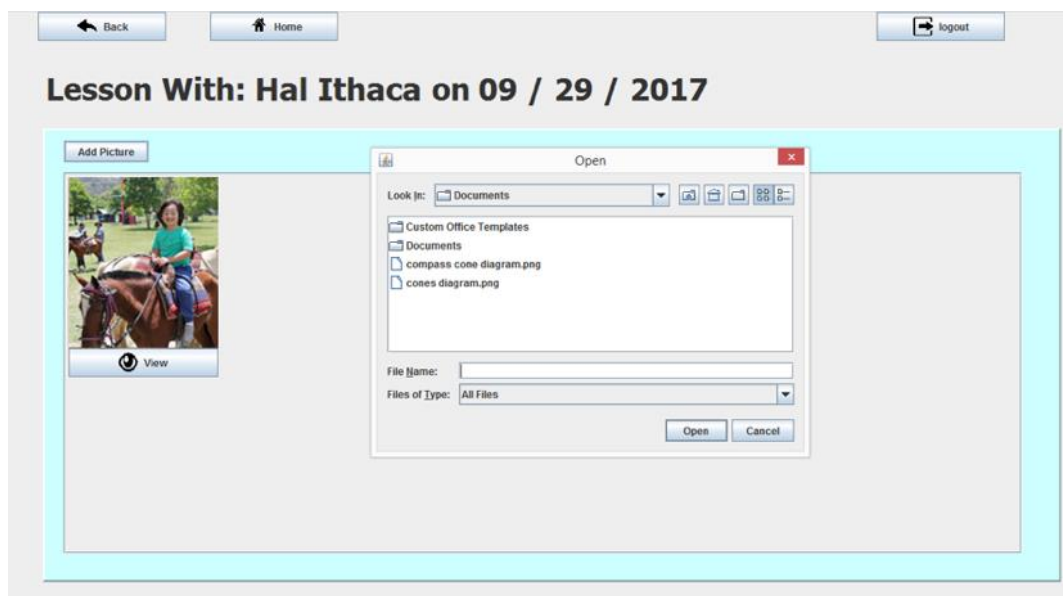
Figure 36 Lesson Pictures Screen

If the picture is on a phone, connect the phone to the computer through a cord and click the drop down at the top of the dialog box select "This PC." From there, you should be able to find a "Removable Media" or something with the name of your phone. This will take you to all the files saved on your phone. Look for a folder that says "Pictures" or "DCIM." This will contain all the pictures you have taken on the phone. Simply locate the picture you want to save, select it, and click "open."

Reading Past Lessons

Once you have saved lessons, there are two different ways you can get to them. The first is from the home screen. Click "Lesson List." This provides you with a list of all the lessons that have you saved as the lead instructor. The below screenshot gives the lessons linked to our instructor "Test." The stars at the right of the list show the lesson rating for each lesson. To view a lesson in detail, click on it.

If you want to only view the lessons for a particular student, click "Student List." This will take you to a list of all students, regardless of if they have been assigned to you or not. You can sort this list by the student's name, the date they were added to the system, or their instructor by clicking the buttons at the top. To select a student from the list, click their name. This takes you to the screen about the student. Click the "Lesson Notes" button in the top left panel. This shows you a list of all the lessons this student has had with any instructor. To view a lesson in detail, click on it within the list.

Printing Lessons

Sometimes you want to see something written on paper, or caregivers ask for progress reports, or you want a backup for power cuts. You could want a print out of a lesson for any number of reasons. At the end of this trial, you can print out the lessons and then add them into your notes binder. Whatever the reason is, you can print both individual lessons and lists of lessons.

To print a single lesson, simply navigate to that lesson's page and click "Print" in the bottom of the screen.

Figure 37 Saved Lesson with Print highlighted

If you have adopted the practice of adding and rating exercises, you may not want to share that rating with a caregiver. The below pop up will appear when you go to print a lesson. If you click "No," the print out will not include any numerical rating of the lesson. Clicking "Yes" will print out all lesson ratings, including the instructor rating, average exercise rating, and the rating of all the entered exercises.
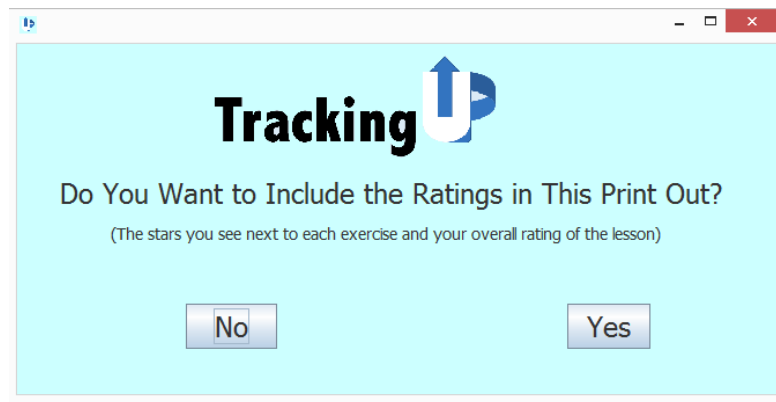
Figure 38 Ratings Print Out Popup

You can also print a lesson list. Whether you are looking at the list of all your lessons or the list of a single student's lessons, simply click the "Print" button at the bottom of the screen and follow the same process.

The Library

There are two parts to this application, a library and lesson notes. One of the ways to tell if you are in the library application or the lesson notes is to look at the color. If you see blue, you are looking at a screen related to a student. If you see fuchsia, it is the library and not related to any specific students. Before you can understand how to track student progress with TrackingUP, you need to understand the library structure. The library is the foundation of everything else.

The library follows the goal, objective, exercise hierarchy standard to PATH guidelines. This is best shown on the left of the home screen in fuchsia.

- At the top are the goals. These are long term ambitions you have with a student, such as a specific dressage test or independent riding.

- Underneath goals are objectives. These are short term ambitions that help build towards goals. So, for the goal of independent riding, an objective would be accurate steering.

- Finally come exercises. These are the day-to-day activities you do with your students to help accomplish objectives, like weaving cones. We saw these when we were entering lessons.

Let's take a closer look at each of these categories as if we were planning a lesson. We will start by looking at goals.
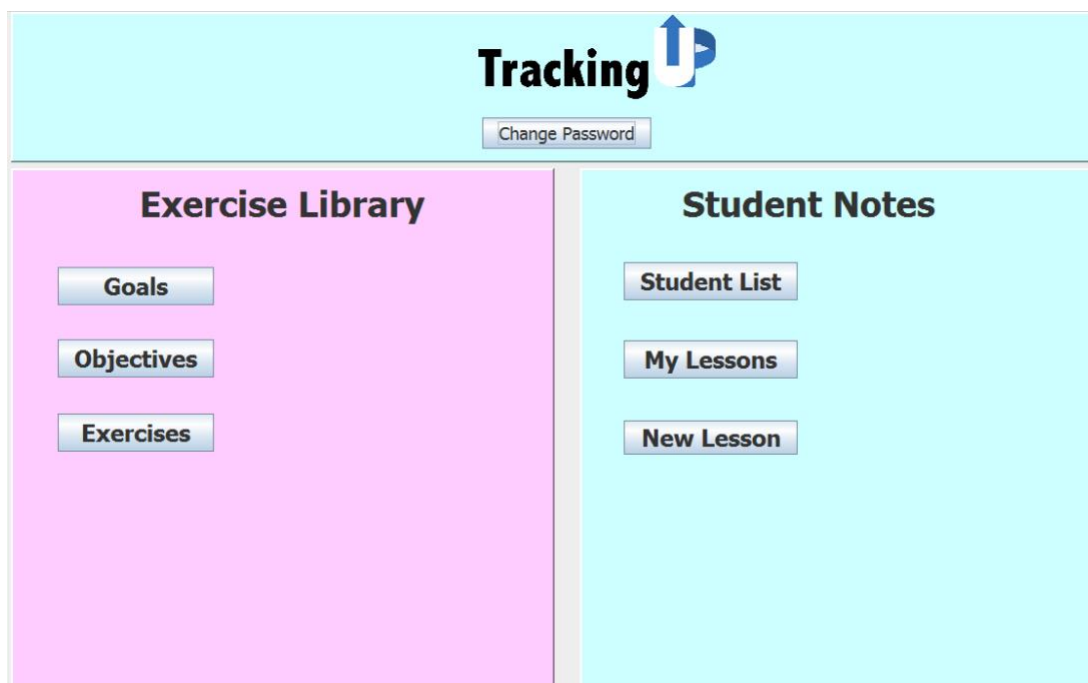
Figure 39 Home Screen, Showing the Library Hierarchy in Fuchsia on the Left

Goals

Clicking the "Goals" button on the left side of the home screen takes you to a list of all the goals that have been saved to the system. Click on a goal to view it.

This will take you to a page that shows you a description of the goal, the level of rider it is appropriate for, and all objectives that have helped instructors build towards that goal with their students.

Figure 40 Example Goal

From this screen, you can edit the goal, delete the goal, or create a new one.

The large panel in the middle shows all the objectives that help accomplish this goal. To see more details on an objective, click on it from this list. To remove an objective from the goal, click the trashcan icon next to it. This will not delete the objective, just remove the link from the goal.

To edit a goal, click the edit button at the bottom of the screen. This will take you to the "Edit Goal" screen. You will also see this screen if you're creating a new goal.

The most important field is the goal's name, at the top. Type in a name that you think summarizes the goal. If you want to share it with others, please try to make the name as descriptive as possible. Underneath the name is the description of the goal. Type what additional details you believe are needed. Underneath that is the riding level. This is the level of rider you think should be working on this goal. You can select multiple levels as some goals are appropriate for riders of all levels.

Once this information is entered, click save.

Figure 41 Goal Edit Screen

Once the goal is saved, you can link new objectives. Click the "Link New Objective" button on the saved goal's screen.

This will take you to a list of objectives. If the objective is in green, it means it is linked to the goal already. Clicking the trash can icon next to it will unlink that objective. To link a new objective, click the + sign next to its name.

To view an objective in detail, click on it in the list. When you link or unlink an objective, it saves automatically.

Figure 42 Add Objective to Goal

Objectives

Objectives are short term steps to get to a goal. These should take a month or two but still spread over multiple lessons. For example, if the goal is Intro Test A, an objective would be balance. To see a list of all objectives saved to the library, click the Objectives button in the home screen. As with goals, this will take you to a list of objectives. Click on one to view it in detail.

Figure 43 Example Objective

This view may be slightly confusing as objectives sit in the middle of the Goal, Objective, Exercise structure. At the top is the title of the objective. In this case, balance. Underneath that is the description. This is a one to two sentence summary of what the objective should be and cautions on working towards it.

Underneath the description, the screen is split into two parts. On the left, are all the goals that this objective works towards. Just as a goal can have multiple objectives that work towards it, an objective can help accomplish multiple goals. In this case, if the student has accomplished "balance," they will be that much closer to riding independently and completing Intro Test A.

On the right-hand side, there are exercises other instructors have used to build towards this objective. As balance is a very popular objective, it has a lot of exercises. These are any and all exercises that can be used to help a student reach completion of the objective.

Figure 44 Edit Objective

To remove a goal or exercise from an objective, click the trashcan icon next to it. This will not delete the goal or exercise from the library, it will simply remove the link to the objective. To edit the objective, click the Edit button at the bottom of the screen. This will allow you to edit the title and description. Simply enter the desired text in the name and description fields and click save.

To add a goal or exercise, click Save at the bottom of the screen. The next part works the same as linking objectives to goals discussed in the earlier chapter. To add a goal, click the link goal button. This will take you to a list of goals. To link a goal that is in black, click the + sign next to it. If the goal is in green, it is linked to the objective. To unlink the goal, click the trashcan icon next to it. These links and unlinks save automatically so you don't need to do anything after the text has changed color.

The process to add exercises is the same, just click the "Link Exercise" button when viewing the objective.

Exercises

Exercises are the building blocks of TrackingUP. You use them in lessons and they build towards objectives. To view a list of exercises saved to the system, click the "Exercises" button in the home screen. To view an exercise, select it from the list.

Figure 45 Example Exercise

The values on the screen are explained below.

- At the top is the name of the exercise. This should be as descriptive as possible but is often just the nickname its creator gave it.

- At the bottom we have the description. This is the step by step directions of how to complete the exercise with your students.

- In the left panel, the riding level is the level of riders. This could be a single level or multiple levels. For instance, beginners will practice how to halt from the walk, but advanced dressage riders will also practice halting.

- The list of objectives is all objectives this exercise builds towards. You can link and unlink objectives by clicking the "Link Objectives" button next to the list.

- The diagram is optional. For exercises that involve obstacle courses or are difficult to explain, instructors may add a diagram to provide better clarity. This can be hand drawn or copied from the computer, anything that works to explain the exercise.

- The Author is automatically filled in with the name of whoever entered the exercise.

- The equipment is anything that is needed for the exercise other than a horse and standard tack (this may include volunteers).

- Requirements and cautions may vary by instructor. These are things you should know going in. They include things such as a warning that the exercise has a high chance of overstimulating your students.

- Secondary benefits can be slightly confusing. These are things the exercise helps students with other than objectives. Some things that you want to work on do not decompose well into objectives or are something that can never be totally accomplished, like social skills or focus.

- Finally, notes are anything other than the description that you want the instructors to know. This could include tips, further ideas, or overall comments.

To edit the exercise, click the Edit button at the bottom of the screen. To create a new one, click the "Create New" button. The process is the same for creating and editing exercises. Again, the most important fields on this screen are Name and Description. If nothing else, fill those out. After that, it is easiest to start at the top left and work clockwise.

Requirements/cautions and secondary benefits are a list of examples generated from interviewing instructors. If you want to document another caution or benefit, click "Other" and enter the information in the text field next to it. If you do not have enough room, put that in notes.

Figure 46 Edit Exercise Screen

To add a diagram, click the "Change Diagram" button on the left. This will open a window for you to select a file. This is the same as you would use if you were posting a picture to Facebook or attaching it to an email. If the picture is on a phone, click the drop down at the top of the dialog box select "This PC." From there, you should be able to find a "Removable Media" or something with the name of your phone. This will take you to all the files saved on your phone. Look for a folder that says "Pictures" or "DCIM." This will contain all the pictures you have taken on the phone. Simply locate the picture you want to save, select it, and click "open." When you are done editing the exercise, click Save.

Once you have saved the exercise, you can add or delete objectives to the exercise. To do this, click the "Link Objectives" button.

This will take you to a list of objectives that looks and works the same as when you added objectives to a goal. If the objective is in green, it is linked to the exercise already. To unlink it, click the trash can icon next to it. This will not delete the objective but will just unlink it from the exercise. To link an objective, click the + sign next to it. These links and unlinks save automatically so you do not have to do anything once the color of the text changes. To view an objective in more detail, click on the name.

Tracking Student Progress

This is the most advanced portion of the application that brings together the library and the lesson notes you have been keeping. This is how the computer tracks student progress and can recommend exercises to you. The foundation of the progress tracking is a shadow of the library hierarchy. While the library is comprised of goals, objectives, and exercises, the progress tracking application is made of student goals, student objectives, and student exercises. A student goal is a reflection of a library goal that is linked to a specific student. For instance, if you create a student goal for Hal linked with the library goal Independent Riding, that is the same as saying you are working on Independent Riding with Hal. The same goes for student objectives and student exercises.

Student Goals

The goals we have looked at so far have been in pink screens. This means that they are in the library and not used by any students. Going forward, we will be looking at goals we assign to students. You will notice as we work through this that all of the screens are blue. This means that you are working with a student record and not the library. Each goal we look at takes the name, riding level, and description of a goal from the library but everything else from the student.

To view a student's goals, open up the student's screen and click "Goals and Objectives."

Figure 47 Student Screen with Goals and Objectives Highlighted

This shows all the goals the student has. The stars next to the goal display how close the student is to completing the goal. The check mark button on the left is the complete button. If you feel the student has completed the goal, regardless of how many stars are next to it, click that button and the system will mark it as complete.

Figure 48 Goals and Objectives Screen with New Goal Highlighted

To create a new goal for the student, click on the "New Goal" button at the bottom of the screen. This will take you to the student goal edit screen. When making a student goal, you have two choices. You can either use a goal that is already saved in the library, such as Intro Test A, or you can create a new one by typing the information into the text boxes. The top box is for the goal's name while the one beneath it is for a brief description. Selecting from the library goals is the easiest option, however, as the system already knows what objectives work best towards that goal.

Figure 49 New Student Goal Screen

To select a goal from the library, click the "Select from Existing Goals" button. This will show you a list of the goals within the library. To select a goal, click on it.

Goals for Hal Ithaca

Order By:

| Usage | Alphabetically | Rider Level |

If adding, click the plus sign next to the goal. Click anywhere else on the row to view the goal.

Independent Riding
    Student can ride the horse with no assistance.

Posting Trot
    Student can rise to the trot in rhythmn with the horse.

Intro Test A
    Complete intro test A without a leader. Moves include: working trot rising, right and left turns, 20m circle both directions, straight diagnal, free walk, centerline walk and trot.

Walk Test 1
    Successfully complete walk test one in a lesson

Training Test 1
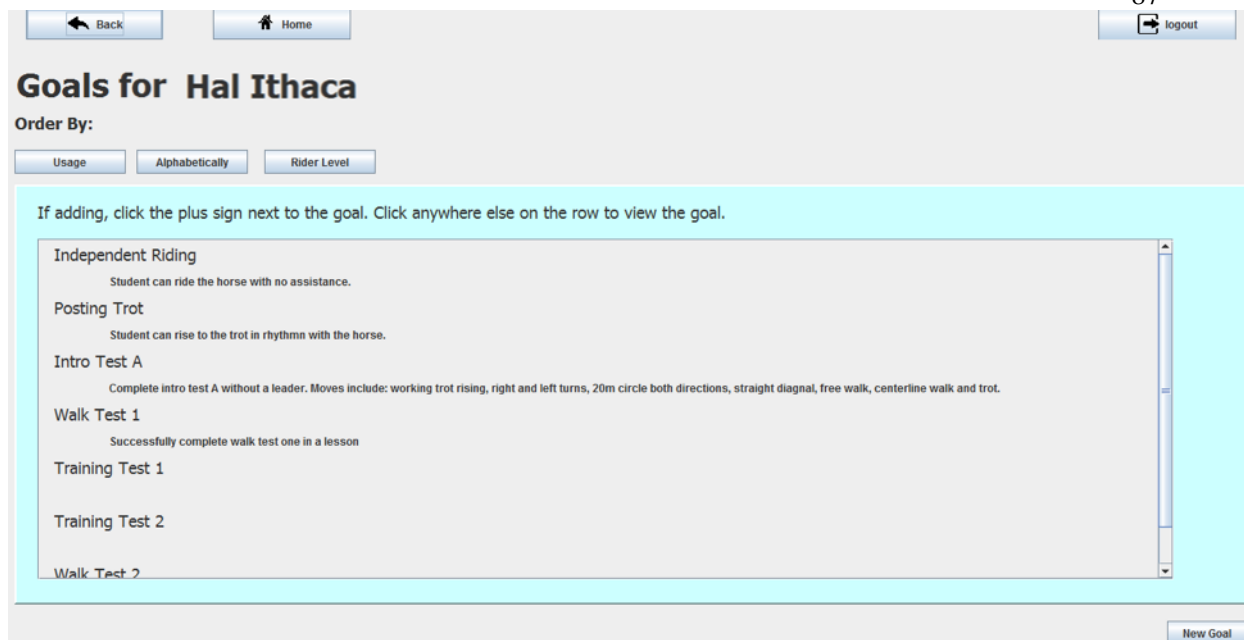
Training Test 2

Walk Test 2

New Goal

Figure 50 Potential New Goals Screen

If you click on the wrong goal, don't worry, you can change your selection at any time. Once you've selected the goal, you will be back at the edit page. Click Save and you are done. Let's look at the result. The below screen is for an existing student goal the instructor has been working on with the student. It has the library entry for the goal as well as the first and last time the student worked on the goal and how close the student is to accomplishing the goal.

In the objectives panel, we see only the objectives that Hal is working towards and that are linked to the goal in the library. The stars next to each objective are how close Hal is to accomplishing that objective. To view an objective, click on it within the list.
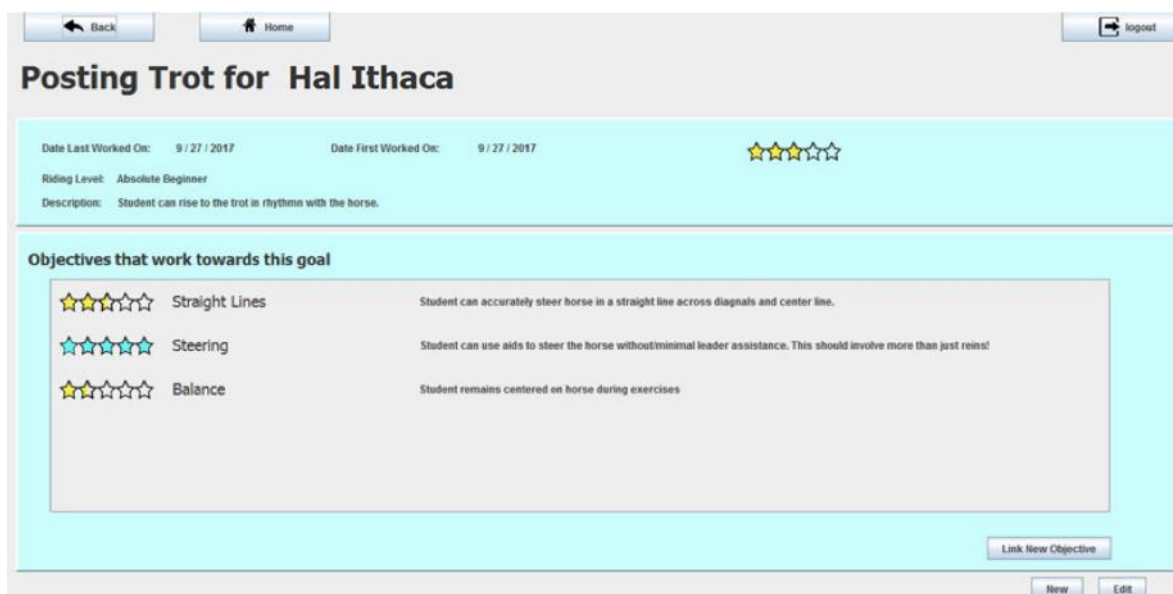
Figure 51 Student Goal Detail Screen

To link a new objective, click the "Link New Objective" button on this screen (if you are on the edit screen, you will not see this button). This screen will look a lot like those in the library, except it is blue and thus linked to a student.

If an objective is green, it is already linked to the goal. To link a new objective, click the + sign next to it. To unlink an objective, click the trash can icon next to it. These linkages save automatically.
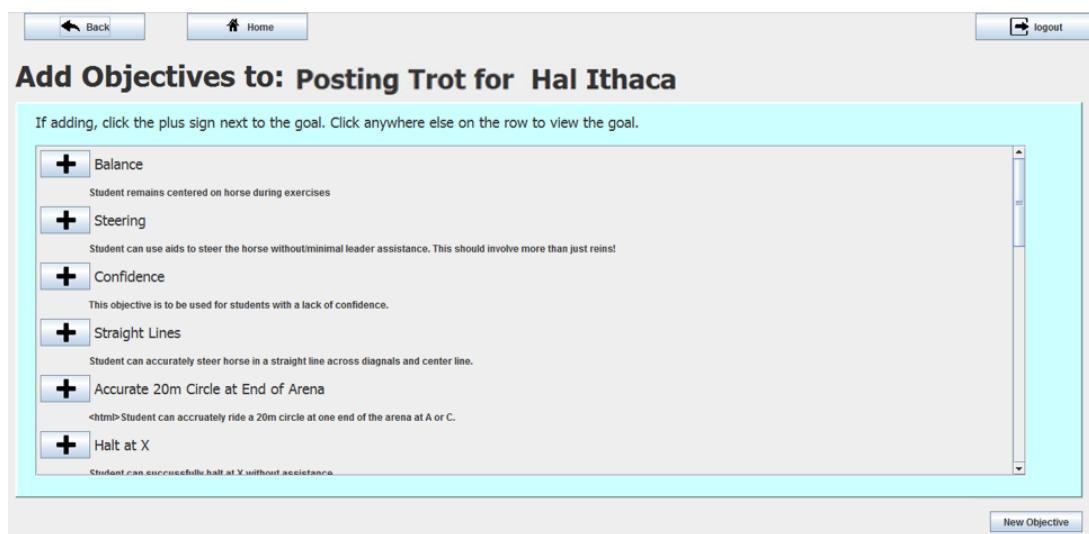

Figure 52 Adding Student Objectives to Student Goal

Student Objectives

Student objectives are like student goals in that they are an entry in the library with a link to a student. You can view a student objective by clicking on its entry from a student goal or student exercise. You can also view it from the list view.
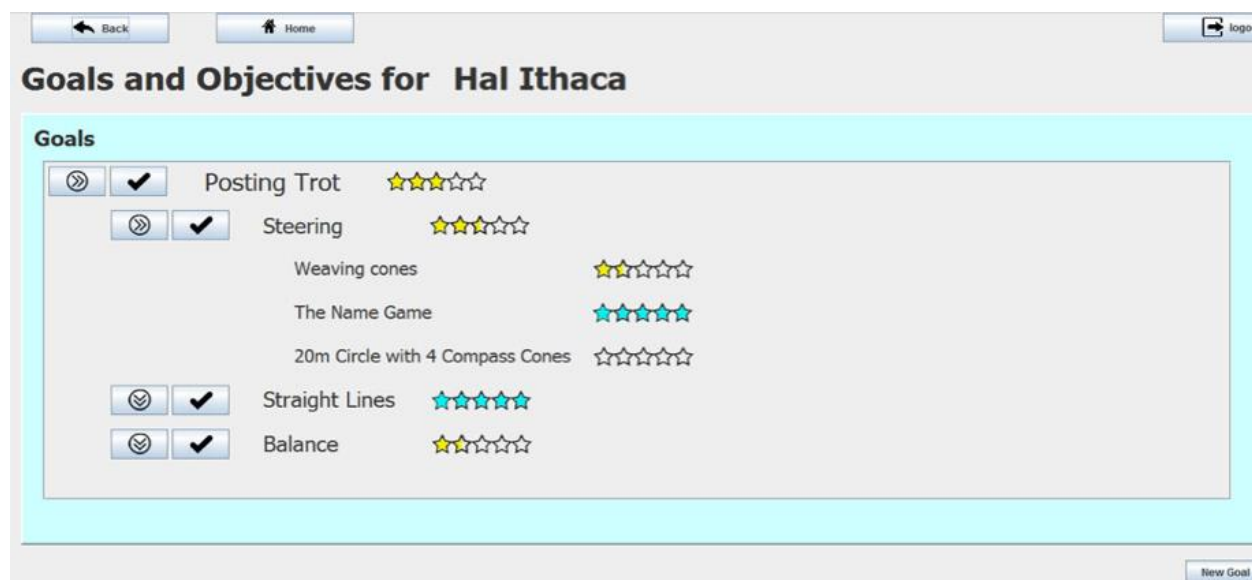
In the goals and objectives page, click the ⊚ button next to a goal. This button expands any list it is next to. In this case, it expands the goal to show any objectives the student is working on linked to that goal. These will be indented. In this example, the goal is Posting Trot and the first objective is Straight Lines. To view an objective, click on it. The next page shows the details of a student objective.

Like the student goals, student objectives take an objective from the library and link it to a student. In this case, it takes the name and description then adds the first and last time it was worked on and how close the student is to completing it. The stars on the top panel show how close the student is to completing the objective.

You will remember this is how the objectives in the library are displayed as well. The panel on the left shows all the goals the student is working on and how close the student is to completing them.

The panel of the right shows all the exercises the student has used that are linked to the objective. The stars next to each exercise show how close the system believes the student is to mastering the exercise. This is based on the most recent times the exercise was used in a lesson with the student and how well it went.

Figure 54 Student Objective Screen

To add a new exercise, click the "Link Exercise" button and follow the directions. This is the same as when you added exercises to an objective in the library. If the text of the student exercise is green, that means it is already linked to this student objective. To unlink them, click the trashcan next to the student exercise. To link an exercise, click the + sign. Adding student goals to student objectives works the same way.

You can only create a student objective by adding it to a student goal or exercise. This is because an objective would be meaningless if it is not linked to a goal or an exercise. Let's look at how to edit one instead. Click the "Edit" button at the bottom right of the student objective screen.

The edit screen allows you to change the description or name. It also allows you to change the objective itself by selecting a new one from the library of objectives. Note you cannot edit the dates or the stars—the system calculates these itself.

Figure 55 Student Objective Edit Screen

Student Exercises

Student exercises are the base of this program. They are instances of a library exercise that were used in a lesson. When you add an exercise to a lesson, it creates the student exercise. No work needed. You can also create exercises by adding them to a student objective. Both of these methods were covered in previous sections.

To view how a student is doing on an exercise overall, click on its entry from a student objective screen, the goals and objectives screen, or the screen for a lesson in which it was used. This will take you to the detail view for that student exercise. As with student goals and student objectives, this will show

you the library entry for the exercise and its description. It will also give you some information on how you have used the exercise with the student.

This includes:

- The rating that you have given this exercise in the most recent lessons, as shown in stars.

- The first and last times you used that exercise with your student.
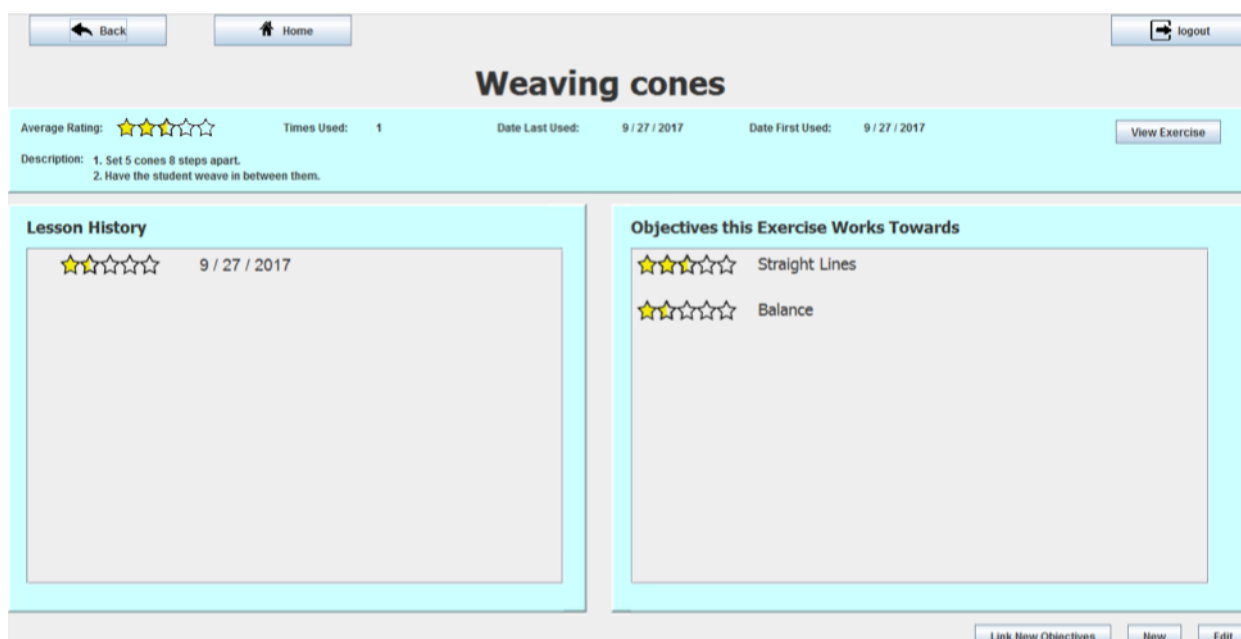
- The library description of the exercise.

Figure 56 Student Exercise Screen

In "Lesson History" you will see a list of dates in which you had a lesson that included the exercise and the overall lesson score for that lesson. To view more details about the exercise, like the diagram, click the "View Exercise" button at the top of the screen. This will take you to the library entry for that exercise.

To view a lesson in which you used the exercise, click the date in the list. To view a student objective that is linked to the exercise, click its name in the list.

Bringing it all together

If you have lessons with exercises and linked up student goals, objectives, and exercises, you are using the whole system. All that remains is to see how it works! As you add new lessons and rate the exercises, the system continually calculates how close the student is to accomplishing their goals. To view this analysis, click on "Goals and Objectives" in the student screen.

Figure 57 Student Detail Screen with Goals and Objectives Highlighted

This will take you to the result screen. This will show you all of the goals the student has and, with the stars next to them, how close the student is to completing them. To view the objectives, click the expand button.

Figure 58 Goals and Objectives Screen with Expand Button Highlighted

Click the expand button next to objectives to view the linked exercises as well.

Once you have been using the system for a while, the screen should look a little like the one

pictured below. With multiple goals, objectives, and progress towards them being tracking automatically.
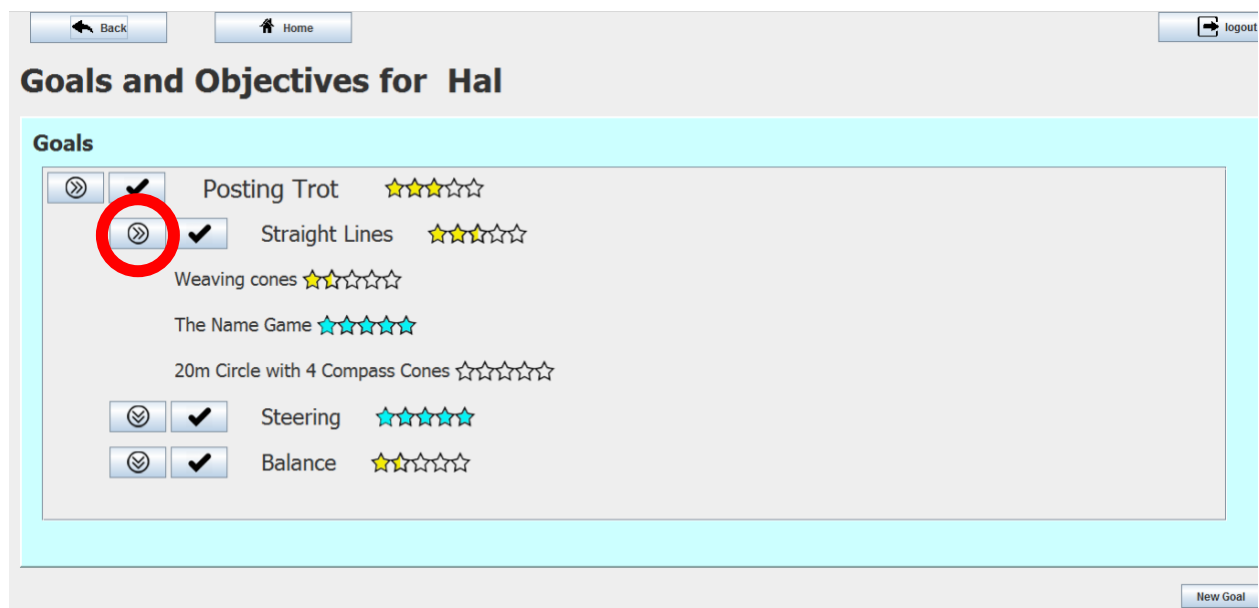

Figure 59 Goal and Objective Screen with the Expand Objective Highlighted

You can see in this screen how the analysis breaks down. The rating of each goal is calculated from the rating of each objective linked to it. The rating of each objective is calculated from the rating of each exercise linked to it. The rating of each exercise is calculated from the last 5 times it was used in a lesson.

So for this screen, you can see that Hal has one goal, Posting Trot. In order to get there, his instructor is working on Straight Lines, Steering, and Balance. Hal has mastered steering but is about halfway to mastering straight lines and his instructor is getting him closer by working on weaving cones, the name game, and 20m circles during his lessons. Hal has mastered the name game, is not yet halfway to mastering weaving cones, and has just started working on 20m circles.

Computers aren't always right, though. If you think a student has completed an objective or goal despite what the computer says, click the ✔ next to it. This will mark it as complete. If you change your mind, just click it again and it will no longer be marked as complete.

ACADEMIC VITA

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Summary

A highly motivated technologist combining strong leadership, communication skills, and a track record of outstanding academic achievement. Led teams in the academic and non-profit fields to success and mentored individuals in fields ranging from mechanical and software engineering to equestrian sports.

Education

Schreyer Honors College, Pennsylvania State University,
College of Information Science and Technology,
B.S. Database Design and Cybersecurity.

Graduation:
May 2018

Experience

- **Deloitte Consulting LLP Business Technology Summer Scholar (Intern)**
  Philadelphia (2017). Project management and design on an nCino Lending Transformation project.
  Pittsburgh (2016). Lead a team of developers on a predictive analytics software project.

- **Pennsylvania State University**
  Smeal School of Business Student Council (2016-2017)
  Webmaster for online services.
  Information Science & Technology (2015-2016)
  Learning Assistant, Introductory Java Programming Course. Developed material, coached students.
  South Halls Residence Association (2014-2015)
  Member of executive council managing public relations.

- **Vex Robotics team,** *Great Valley Middle School*
  Coach to Pennsylvania State semifinalists team.

- **Weekend Barn Manager,** *Hope Springs Equestrian Center*
  Horse riding instructor, volunteer recruiter, event organizer, technology consultant.

- **Volunteer trainer,** *Thorncroft Equestrian Center*
  Lead in design, advertising, and running of a series of multimedia clinics on advanced horse knowledge.

Honors and Awards

- Dean's List (8 consecutive semesters), Schreyer Honors College (2014-2018)
- Multiple Scholarships including:
  - PNC Technology Scholarship (2015)
  - Raytheon Scholarship (2014)
  - Pensa Family Scholarship (2018)
  - IST Recognition Scholarship (2014-2016)
  - Schreyer Honors Scholarship (2014-2016)

Multiple Honor Societies including:
  - Phi Kappa Phi (2016)
  - Gamma Tau Phi IST Honor Society (2015)
  - Phi Eta Sigma (2015)

- Presidential Gold Volunteer Award (2008-2014)

Additional Abilities

- Proficient in Java, Ruby, HTML, SQL, and web development
- Proficient in Microsoft Office, Analyst's Notebook, and Internet Research
- Triathlete, Horse Rider