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An Application of the Autism Management Platform to Tracking Student Progress
in the Special Education Environment

A Thesis by
Ryan Thomas Burns

Chapman University
Orange, California

Schmid College of Science and Technology

Submitted in partial fulfillment of the requirements for the degree of

Master of Science
in Computational and Data Sciences

May 2015

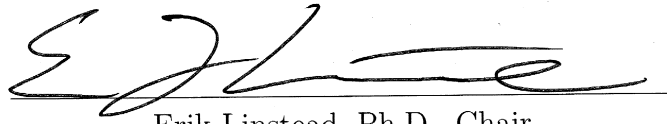
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Erik Linstead, Ph.D., Chair

A handwritten signature in black ink, appearing to read 'Peiyi Zhao', written over a horizontal line.

Peiyi Zhao, Ph.D.

A handwritten signature in black ink, appearing to read 'Dennis Dixon', written over a horizontal line.

Dennis Dixon, Ph.D.

May 2015

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ABSTRACT

An Application of the Autism Management Platform to Tracking Student Progress
in the Special Education Environment

by Ryan Thomas Burns

In the age of online courses and digital textbooks, several areas of academia, such as special education, are far behind in the technological revolution. Some teachers use long unstructured digital documents, while others maintain large physical files for students containing every piece of information or coursework they have ever received. Could these extremely unstructured approaches to data collection and aggregation be streamlined with a software platform built specifically for this purpose? Could this platform also be built to accommodate multiple integrations and practical new features? Most importantly, in terms of usability, would this software be enjoyable to use? The Autism Management Platform was initially built for parents of children with Autism to be able to post and view various events and activities throughout their child's life. The platform now allows for communication on posts between parents, teachers, physicians, and anyone else involved in the child's life who is authorized to do so. What started as a general platform built for Autism was able to adopt an integration specific to special education. The Autism Management Platform was then further enriched by new features, such as the addition of appointments and visual schedules, proving that it could serve beyond the platform it was intended to be. Through several semester-long user trials in high school special education programs, it was found that real people could use an integration of this platform in an enjoyable and meaningful way.

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Chapter 1

Introduction

The Autism Management Platform (AMP) is a software based system built to enrich and refine the process of data collection and management for children diagnosed with Autism Spectrum Disorder (ASD). AMP also serves as a means of communication amongst those involved in a particular child's life. People interacting with the system could be parents, siblings, teachers, physicians, or therapists. Those authorized to view a child's profile or data feed can interact with each other through commenting on posts about that child.

An overarching goal of this study was not only to build the system, but to determine if it can actually serve as the platform that the name suggests. A platform like this should allow for a few very important things. First, it should allow for new features without extreme overhaul. If the system is going to last, it can't remain stagnant in its features. New technologies are always being introduced and the platform should be able to accommodate as many as needed. Second, it should generalize for seamless, but multifaceted integrations. If AMP is chosen to be used in a special education program, the system should be able to easily adopt or integrate any specific requirements that program might have. This often may include the reorganization or removal of functionality to fit the needs of the study. Lastly, the

platform features should be applicable not only to Autism, but to the entire arena of special education.

Original contributions of this study include a platform that supports flexible and multimedia data collection as well as a means of communication between caregivers, the integration of Individualized Education Programs into a pre-existing data collection platform, and first steps towards incorporating wearable technology into the ASD space. Each item stated here will be explored further in this thesis.

The platform takes many forms, but this thesis will focus primarily on the mobile front end interface. With this in mind, usability is another major factor. If people are going to be using the system, AMP's mobile front end interface should be as easy to use as possible. Testing through user trials will be discussed in a later section to further emphasize and explore the idea of usability.

The origin of AMP came about in an undergraduate course setting, in a CPSC348 Software Engineering course at Chapman University in the Spring of 2013. The course aimed to teach students how the software development process worked, and by splitting up into teams, the group would build a product from the ground up. The motivation for the initial project came from our instructor, Erik Linstead, PhD., who not only had previous interest in Autism, but also had a personal and familial connection. The idea was to build a mobile application that would allow a parent to post events and information about their Autistic child's day and view items that they had previously posted. These posts could contain text, checklists, or multimedia. Along with this came the need for several other subsystems, including a web platform geared more towards physicians, rather than parents. Several requirements were formulated by a process team, requirements were turned into features by a development team, features were tested by a test team, and a final deliverable was produced under the name "Autism Feedback."

At the end of the semester, it was clear that Autism Feedback had an abundant amount of potential. We wanted the project to mean something more than a grade in a grade book. The opportunity for further research and development was extremely exciting. There were many potential benefits to be gained in conducting further research. Autism Feedback's main purpose was to streamline communication between caretakers of a child with Autism. The first thing that was decided during research was that we wanted to focus more on the need for a software platform similar to what we were creating. In so many educational and medical environments, caretakers are using Word documents and spiral notebooks to collect sensitive data. Parents transitioning their children from doctor to doctor or from teacher to teacher just makes this process more cumbersome, requiring parents to repeat large amounts of information over and over again. We wanted to focus even more on streamlining data collection and aggregation to explore fixing this problem. Along with streamlining this process, additional research was being conducted by other groups to study things like trend prediction with the data collected. At this point, what was once a mobile and web application called "Autism Feedback" was now a platform, just waiting for new features and integrations, called "Autism Management Platform."

In this thesis, we first introduce Autism Spectrum Disorder and the need for a digital platform for special education in general. We then quickly move on to describing the process of building the platform, including descriptions of all core features and the design decisions behind them. Directly following this is a discussion of the setup and duration of several user trials. Near the end of the thesis, we discuss experimental results and shortly following, a comprehensive analysis of those results. Finally, we explore the opportunities for future works that our platform and newly found results produce.

Chapter 2

The Need for a Digital Platform

The majority of motivation for creating a platform like AMP comes from the lack of any digital data collection platform in the area of special education. As technology progresses, the school system in general lags behind, but when schools begin to catch up, it seems as though special education programs are the last to adapt. This is most likely due to the abundance of information that special education teachers and teacher aides have to collect about their students. For example, high school special education classes don't only focus on course material like the rest of the school programs. There is an enormous emphasis on behavioral progress as well, like you might see in a typical kindergarten class. A platform like AMP would benefit the system in several ways. It would greatly improve the way in which data is collected, retrieved, and filtered. This would also allow for a data analytics platform, allowing caretakers to detect certain trends in a particular student's progress over time. Current methodologies for data collection in special education programs prove to be inefficient, unorganized, and therefore ineffective.

2.1 Never-ending Word Documents and Six-inch-thick Notebooks

An early observation that was made influencing our platform was the way physicians in the medical field went about data collection in general. Potentially structured data such as age, gender, address, and previous medical conditions arrive in the form of paper documents, which are collected from patients, scanned, and placed into a physical file. The digital file is nothing but another copy; there's no intelligence storing the data there. If there is any sophisticated data storage, input is by means of manual data entry by a secretary or office clerk.

Unstructured data comes from a patient in the form of personal responses to questions that a doctor may have. This might be how a patient is feeling, how a certain medication is working, or how a child is progressing. Collection of unstructured data tends to be even more disorganized. This differs from physician to physician, but in several cases, this data is collected via pen and paper, sometimes in large notebooks, and often times in a long, drawn out word processing document. With this kind of collection, unstructured data stays true to its nature: unstructured. With data collection being at the center of technology today, we now understand that unstructured data is extremely important, especially in the medical field. The means of collection could be much more efficient.

It turns out that efficiency isn't the only downfall of this method of data collection. Parents of children with Autism often find themselves having several appointments each week, all with different physicians, therapists, teachers, etc., forcing them to repeat and record information over and over again. Having to repeat information so many times is inefficient, but what's worse is that information can easily become distorted from caretaker to caretaker. We saw a huge gap here. It would

make much more sense if all of this information was kept in one place – a place where each caretaker involved in a child’s life could keep up and communicate, all towards the well-being of the child.

This same problem persists in an educational setting as well. The difference in special education is that most of the focus is on progression of a student socially rather than medically. In most special education classes, there is a single teacher, and several teacher aides. The teacher is in charge of lesson plans, while the aides focus on specific students. Parents also play a significant role. Teachers and aides are in constant communication with parents of students. We found that data collection in special education is similar to what we found in the medical setting. At school, progression data such as progress on particular goals are recorded with paper and pencil. Similar methods take place at home, depending on the parent. What’s most interesting about this relationship is that the child spends about half their time at school and half their time at home, but their behavior clearly varies between the two. This means that parents are often surprised when they see weekly or even monthly progress reports from teachers or aides at their child’s school. We found the same gap in this setting. If parents had a better way of communicating with teachers and aides, the relationship could go both ways. Parents could see how their child was acting at school and teachers/aides could understand how the child is at home. Our vision is that AMP is a solution that could help caretakers find a middle ground, improving upon the child’s care and education.

2.2 Digitized Progression Tracking

Special education is a perfect subject for this platform, mostly because the application of computational progression tracking is nonexistent. As stated earlier, most

progression data in special education pertains to certain social and educational goals for each student. Teachers and aides fill our forms recording a student's progress on their current goals. This usually includes a percentage and a description. Once a student completes a goal, it's done and the progression path the student took to get there is nothing but history.

Even though these goals are set by caretakers and are specific to each student, past data is still compelling and could still mean something for the future. Factors that drive a student with a particular disorder to complete a goal in a certain amount of time have the potential to help another student with the same disorder. Digitized collection of all of this data would inevitably bring abundant amounts of research opportunities.

This type of integration would work very well with a platform like AMP. With goal progression data combine with posted data via AMP, someone could potentially associate a faster rate of progression with a schedule change or a decrease in tantrums at home. The most glaring benefit that special education could use with a platform like AMP is to be able to further structure their current goal framework, giving the opportunity to relate this rich time series-like data to other events posted through the system. With this, and possibly some visual tools to accompany, prior data would mean more than just history, and it would be much simpler for a parent or teacher to see the rate at which a particular student has progressed over time.

2.3 Data Mining and Trend Prediction

An overarching goal of the platform that we build has always been to have the opportunity of complex data mining and trend prediction. Although such notions are

not deeply explored in this thesis, it's important to see the opportunity. By including so many various parts and functionalities in the platform, associations between two or more variables would be a breeze to evaluate.

The most glaring thing in terms of data analytics is the fact that all of our data is on a time scale. This means that every single feature we have, such as timers, tags, schedule changes, and even posts in general can be plotted against time. Time series models are perfect for analysis of trends and seasonality in data. If we were to do some time series analysis, we would be able to detect trends, and then plot those trends against other factors that might influence those trends.

First, it's obvious to see the opportunity for linear regression. The question is - can a certain response variable be predicted or influenced by one to many other explanatory variables. The most common method for doing regression is hand-picking these variables. In our case, one might be: can the amount of schedule changes increase the number of tantrums in Autistic children? If the result is positively conclusive, what other factors do schedule changes influence? Perhaps in a special education setting, could we also predict when a goal for a student will be met? A more sophisticated approach in performing regression is computational model building. A fair amount of this process remains subjective, but there is much more objectivity involved, due to the computational nature. This process involves taking a model with all variables, and programmatically deciding which variables affectively influence the response variable based on statistics [6]. Model building is most useful when the most influential explanatory variables are unknown, and commonly discovers new and unexpected results.

Aside of regression, trend and seasonality analysis, time series data also allows for sophisticated ways to do prediction, given prior time data. A popular and affective way of doing prediction with time series data is through the Autoregressive

Integrated Moving Average (ARIMA). ARIMA models are often fitted to time series data to better understand the data, but more often fitted in order to predict future points. This process is called forecasting [6]. In a 2003 study, research scientists used ARIMA techniques to model and forecast electricity prices in the next coming weeks [7]. The ARIMA process could be used similarly with AMP. Given factors like amount of certain tags and checklist progress over time, one could use a model like this to possibly predict the amount of tantrums in the next coming week. The reason a process like ARIMA rises above simple regression in this respect is because it takes into account the fact that more recent data is more important, and averages change over time.

The possibilities in data mining and trend prediction are seemingly unlimited, but with current ways of data collection, are nearly impossible. There needs to be a more standard, systematic, and organized way of collecting this feature rich data computationally in order to make these possibilities come to life. We believe that AMP is just the beginning of streamlining the way this kind of data is collected

Chapter 3

Autism Spectrum Disorder

Although this thesis aims to discuss progression tracking in special education areas in general, the origin of our research came from interest in Autism specifically. Several decisions were made with knowledge of the Autism Spectrum Disorders, common symptoms, and the typical lifestyle of a parent of a child with one of these disorders. This information is worth exploring.

3.1 The Spectrum

Autism Spectrum Disorder (ASD) is a complex disorder of brain development. The disorder is historically known as Autism, but in May of 2013 was further generalized to include all autism-related disorders under the common grouped name of Autism Spectrum disorder [3]. Other autism-related disorders include Asperger Syndrome, Childhood Disintegrative Disorder, and many others.

ASD can be associated with many different areas of disabilities including intellectual, motor skills, and physical health. Most commonly, children with Autism

have medium to severe social interaction disabilities, and experience extreme anxiety in situations that others may perceive to be normal. According to the U.S. Centers for Disease Control and Prevention, as of 2010 over 3 million people in the U.S. are affected by ASD, identifying about 1 in 68 children as being on the spectrum [1].

Every individual case of ASD is unique. This is the main reason for the word “Spectrum” in the name. Nearly 40 percent of children with Autism have above-average intellectual abilities. In many instances, Autistic children rise above the rest in visual, music, or academic skills, but fall short only in social ability and perception. About 25 percent are nonverbal, but are able to easily find other means of communication due to their sharp intellectual skills.

3.2 Diagnosis

There is lack of data to say exactly when ASD begins in children, but there is strong evidence that it may actually occur in utero. In most cases, the obvious signs and symptoms of Autism are prevalent around ages 2 or 3. Many believe that the earlier the diagnosis, the better the outcome in terms of behavior severity.

Before a physician gets involved, parents often see signs in children with autism such as failure to make eye contact, walking on the tips of their toes, less than normal communication methods, and playing in unusual, repetitive ways. When a parent notices these or several of the other common signs of Autism, they are encouraged to see a physician.

Presently, there is not a medical test for Autism diagnosis, so it is accomplished by behavioral analysis. There exist Autism specialists such as physicians and psychologists who are specifically trained to administer such tests. The parent or

guardian first takes a test, answering questions about their child. This test is called The Modified Checklist of Autism in Toddlers (MCHAT). A positive result here would suggest that the child should be further evaluated.

The child evaluation involves several people with specializations in many different areas. This test typically involves both behavioral and physical assessments. A behavioral assessment often includes medical history tests, clinical observations such as observation and perception tests, and developmental tests measuring response delay times. Quite often, a physical test is also performed. This test is usually to determine if other physical factors may be causing these symptoms, rather than ASD. These exams include a typical physical exam, hearing tests, and testing for lead poisoning [2].

Research is currently being done to determine what factors may cause Autism, pre or post birth. In a 2007 study, it was found that blood levels of Mercury may actually be linked to Autism [5]. Research is also being done to find a way to be able to test for Autism medically, rather than subjectively. Causes of brain disorders such as ASD are continually being researched, but are not further addressed in this thesis.

3.3 Sessions, Classes, and Appointments: A Busy Lifestyle

Progression of Autism in children is constantly being evaluated. As a result, children with autism have extremely busy schedules. A typical week may consist of medical appointments, psychological evaluations, physical therapy, speech therapy, and much more.

In an educational setting, appointments are also required with much more frequency. Special education students and Autistic students especially can be sporadic when it comes to their performance in school. A student's performance is likely to change more than once a semester or year. For this reason, parent-teacher conferences occur more frequently.

It's safe to say that both children with Autism and their parents have an extremely busy and stressful lifestyle. Anxiety is often attributed to a hectic schedule; this turns out to be a fact not only for children with Autism, but also for children with other behavioral, social, or learning disabilities. Children with autism have increased difficulty dealing with stress and anxiety, so the ability to manage a chaotic and constantly changing schedule in an efficient way is crucial to their well being.

Chapter 4

Related Work

The general idea of streamlining the data collection process in special education is not a particularly original one. Related works exist, but several seem to leave out the idea of generalization. Each solution seems to be too specific, leaving out common functionalities that many users would want to use, such as attaching media or including a checklist. Many existing applications act more as a journal than a progression tracking application. Through talking to users, we've learned that everyone wants something different, so the best thing to do is to generalize for anybody. Another pattern in existing works is the lack of intuition and usability. This is something that AMP focuses on. Our system puts the user at the center, understanding the nothing we do will matter if users aren't engaged.

Below is a brief list of related literature in the field, as well as comparative descriptions of each.

4.1 “Interactive visual supports for children with autism” [8]

Over several years of autism research, many breakthroughs have been made in tools for diagnosis and analysis. “Interactive visual supports for children with autism” focuses on tools for behavioral and communication studies. The article’s function is to present a wide array of visual aids, both electronic and non-electronic, that serves a purpose not only in obtaining results for analysis, but also helping the child with things like basic communication, prompted situations, and option selection. It is stated that although there are concerns about using mobile electronic tools as visual aids for autism diagnosis and analysis, it opens up a whole world of research. Electronic visual aids have the potential to allow complete customization. An area of use for this might be in machine learning, where a system might be able to adapt to a particular user based on previous results. Use of these devices would also allow for digital data logging, giving even more opportunities for aggregation of the results. With all of this useful data being collected and analyzed, what seems to be missing is context. Researchers might want to know more than the fact that scores rose or sunk. They might want to know how scores changed in terms of an independent variable, for example: a non-trivial change in the child’s schedule. The real compelling analysis here would be determining when or why scores from these visual aids were as high or low as they were.

4.2 “Parent and physician attitudes regarding electronic communication in pediatric practices”

[9]

“Parent and Physician Attitudes Regarding Electronic Communication in Pediatric Practices” models the willingness to use methods of electronic communication (email in this case) for certain instances of parent-physician interaction. Two binomial experiments were conducted, to collect percentages of parents and doctors who:

1. Had access to electronic communication
2. Showed interest in using electronic communication for patient data

Conclusions of these experiments determined that although internet access varied depending on age group and family income, majorities of both parents and physicians had means of communication electronically. The more interesting part of the results was that although both parents and pediatricians were aware of the privacy issues surrounding electronic communication of medical data, most parents expressed interest, while physicians were generally opposed to communicating electronically in their practice. This information is useful to understand why communication with technology increases, but practice of electronic communication tends to stay the same in certain areas such as the medical industry. Something the article lacks is any idea for a solution, which would seem to be something that deals with physicians’ concerns elegantly, causing them to be more willing to move in this direction.

4.3 “Management of children with autism spectrum disorders” [10]

Many comprehensive programs exist to deal with and treat common problems among children with ASDs. “Management of Children With Autism Spectrum Disorders” states that several of these programs have common goals, such as inclusion of family into therapy/training, and ongoing measurement/documentation of the child’s progress towards educational objectives. These goals are shared in order to do things like analyzing predictable routines and study common behavioral trends. The article’s purpose is to emphasize not only the recognition and evaluation of ASDs, but the management of them. The authors also mention the concern that the abundance of programs a particular child is involved in may actually interfere with progress. All of these comprehensive programs exist for the management of autism, but what has been overlooked is the management of the programs themselves. What is needed is a solution that is able to manage things like this without being intrusive or hindering progress; a system that would present itself in a natural way, as if it wasn’t there at all.

Chapter 5

Building the Front-end Autism Management Platform

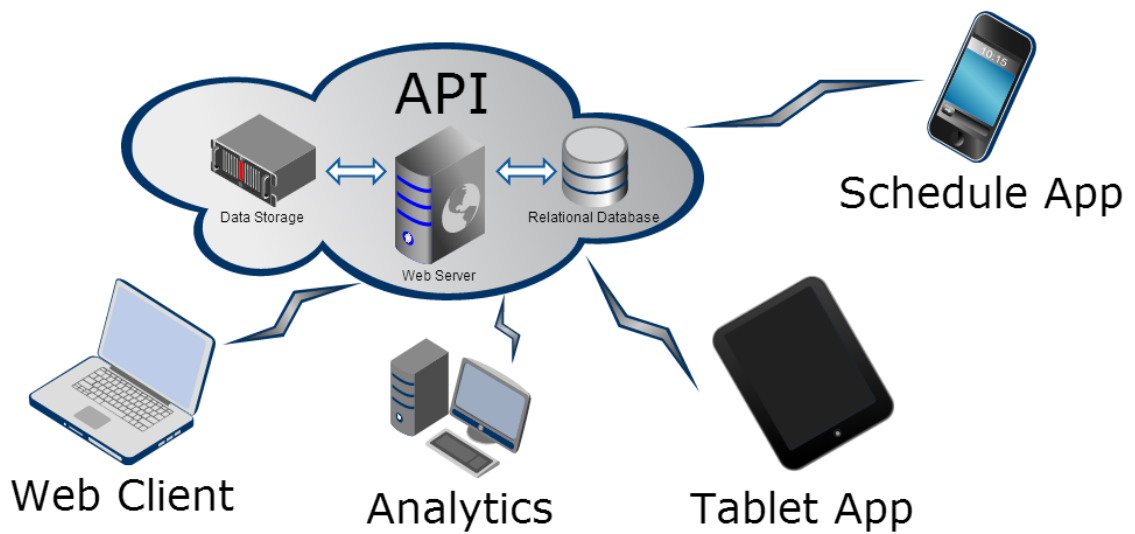


Figure 5.1: AMP System Architecture Diagram

The structure of AMP is fairly complex. Data is to be collected, stored, aggregated, and then eventually mined. To attain this sort of data flow, an entire system needed to be built. Each step in the process needed its corresponding subsystem. Figure 5.1 graphically shows how all of the subsystems work together.

For data storage, a relational database engine with persistent disk storage is in place. This serves as AMP's central data store for all front-end and back-end subsystems. A RESTful API directly interfaces between all front-end subsystems and the central database. Although data storage and API structures must be in place for AMP's front-end to function, they will not be further discussed in this thesis. These essential parts are further discussed in depth in a parallel in-progress thesis.

The front-end subsystems of AMP include both a web client interface and an Android tablet application. This thesis primarily addresses AMP's mobile front-end subsystem, which is the first and probably most important part of our data flow process, data collection. Without a proper and effective way of collecting the data, the rest of the process (storage, aggregation, mining) would not be able to take place.

Data that is posted through AMP's front end is eventually aggregated and presented in AMP's external data analytics platform. From there, one can view trends and filter on items posted about a particular child. This platform is not discussed in this thesis, but in much greater detail in a parallel in-progress thesis.

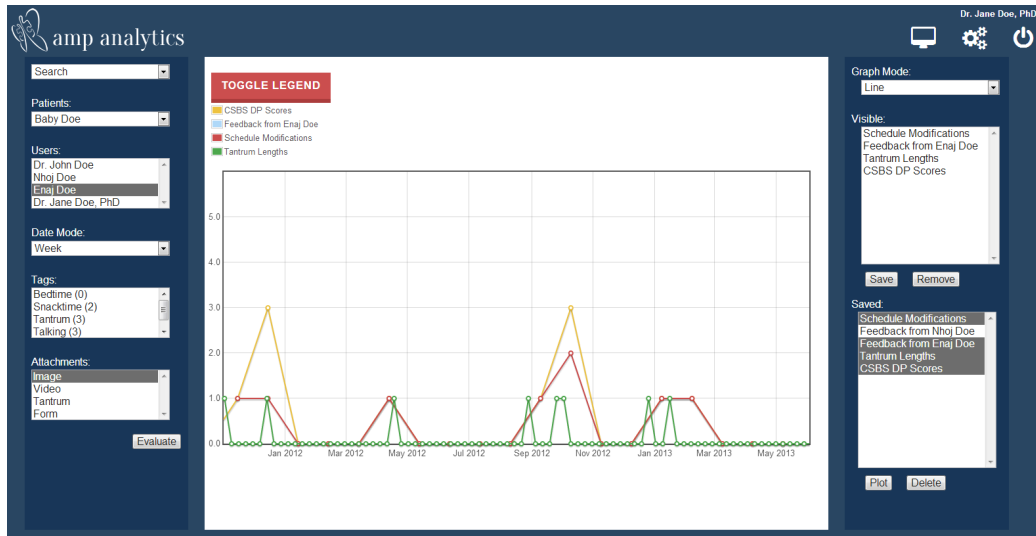


Figure 5.2: Analytics Plot Example Showing Relationship Between Schedule Changes and Tantrum Length

5.1 Design Decisions

Several design decisions had to be in place for every feature that graces the platform. Before making any of these decisions, we first had to consider who would be using the application. Most common usage would be by the parent of a child with Autism. The parent would use the application in the comfort of their home, at school, or at the doctor's office. They would use AMP for 2 primary functions: to post information and to view information. With this in mind, we knew that the medium for this front-end subsystem needed to be a mobile application.

Due to the media-centric nature of AMP's front-end, it made the most sense to design AMP for a tablet-only interface. Viewing feeds of information and submitting media rich posts require a fair amount of screen real estate, so it would not make sense to design for phones. If it became necessary, support for smaller screens would be developed in the future.

The next decision that needed to be made was which operating system AMP’s mobile application would be build on. Several factors went into the decision of building on the Android platform. The first reason was simply that Android provided more freedom in terms of development, interface, and permissions compared to alternative competitors. When designing AMP, we knew from the start that we did not want our application to be released to any application store, and that first we would eventually want to conduct closed user studies. Android applications can be deployed on several different types of devices ranging in size, price, and hardware, giving us the freedom to test our application intelligently and cost effectively.

Many design decisions also needed to be made in order to shape AMP’s user interface. If parents were going to use this application on a near daily basis, it needed to be aesthetically pleasing, intuitive, and easy to use. Depicted in figures presented in this chapter are pleasant blue and white colors, large graphic icons for actions, and clearly labeled buttons, all geared towards an optimally friendly user interface. To further assist in usability, no functionality in the application requires more than a 1-screen-deep interaction, meaning that the user is never more than a step away from getting back to the home screen.

5.2 Easy Setup

AMP’s mobile application makes it easy to get logged in and ready to start posting. Logging in is simple. All a user needs to do is enter their user name and password. Once they’re logged in, they can configure their account by tapping the settings icon on the feed screen.

A user can do several important things from the settings screen. They first can view a list of all of the children they are managing. When a child is selected, they will be able to see other users authorized to view that child's feed and profile, as well as authorize a new user (by email).

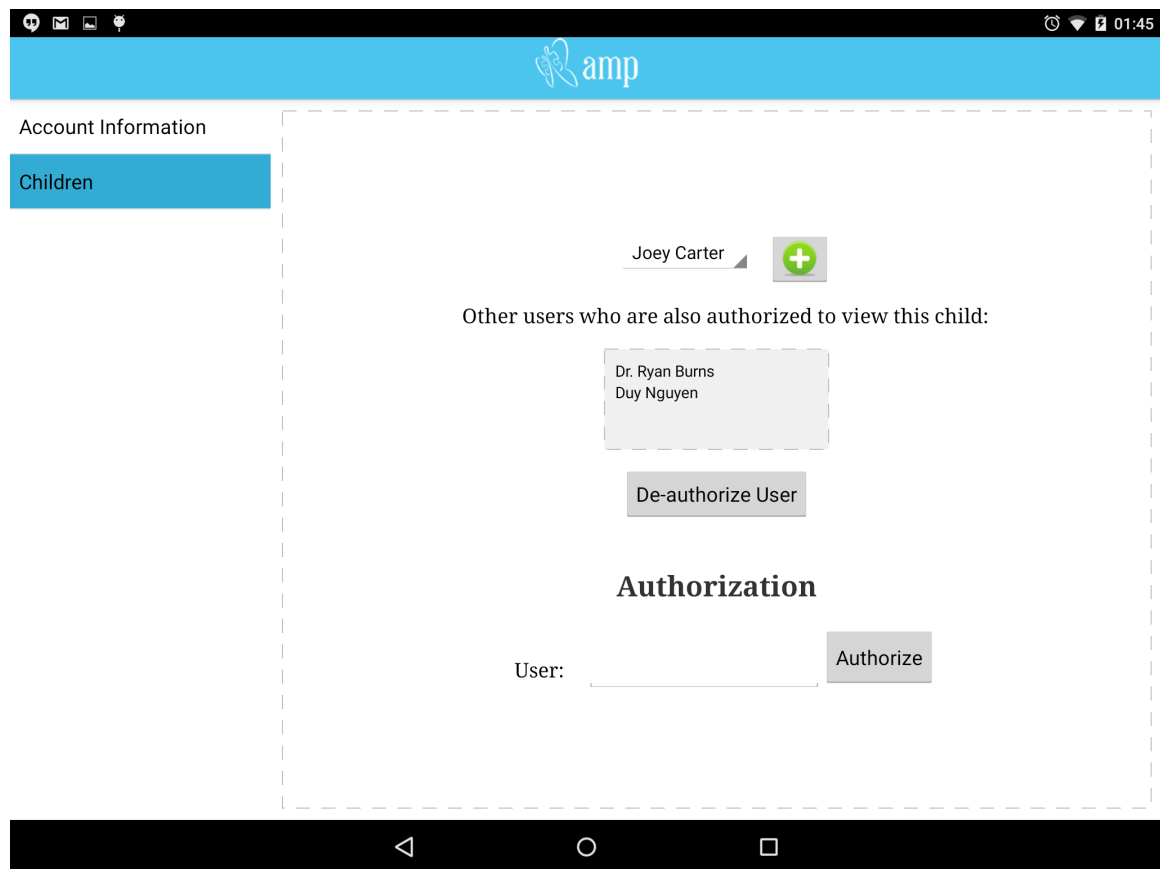


Figure 5.3: Settings Screen

Also from the settings screen, a user can create a new child profile by tapping the *add* button. From the add profile screen, depicted in figure 5.4, a parent user can create a child profile by adding information such as name, gender birthday, and extra optional hereditary information.

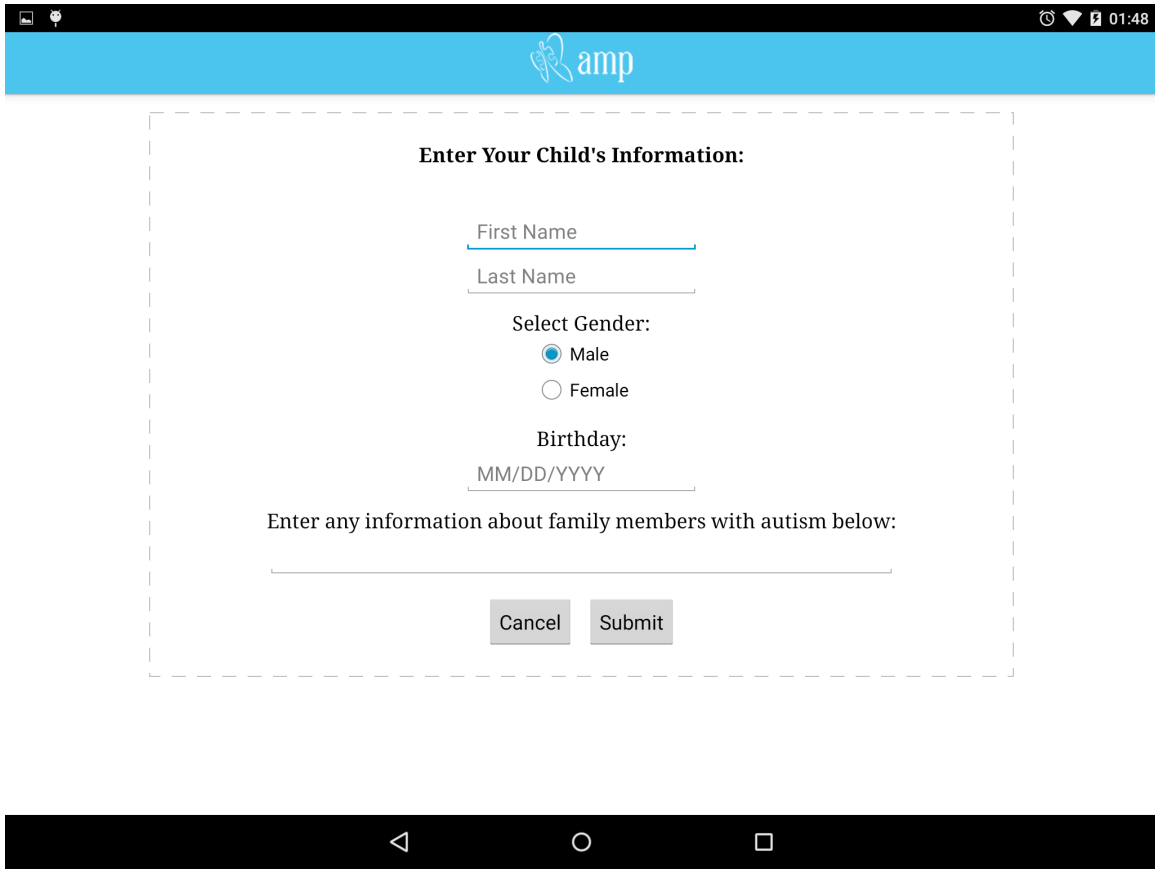


Figure 5.4: Add Profile Screen

5.3 Posting Events and Information

One of the most common use cases for a parent using AMP's tablet application is the act of making a submission. Submissions in AMP are designed to be completely multifaceted. They can contain submission text and as many attachments as needed. Possible attachments include tags, milestones, images, videos, audio recordings, checklists, timers, and events. A parent can post a submission pertaining to any of the child profiles that they are authorized to view.

Posting submissions from AMP is designed to be simple and user friendly.

There are two ways a user can choose to submit a post. The most common and primary path is to choose the submission button shown in the upper right hand corner of figure 5.10. This button will take the user to the submission screen, allowing them to add submission text and any corresponding attachments. The submission screen is depicted in figure 5.5.

Attachments	Milestone	Tags
Image attached	Rolling over	Bedtime
Tantrum Timer attached	Hugging	Snacktime

Figure 5.5: Submission Screen

Another way a user can quickly start a submission is by tapping one of the four attachment options on the main feed screen. These options serve a quick way to include attachments in a post, rather than starting a new submission.

Submissions are the most interesting part of AMP in terms of data analytics. Some information included in submissions is structured, while some is unstructured. Attachment types are described below, along with applications to data analytics and trend prediction.

5.3.1 Tags and Milestones

A user can include as many tags as needed in a submission. In AMP's back end there exists a global list of tags. Tagging a post with bedtime, for example, might suggest that the rest of the information included in the post might have been about bedtime. These serve as one of the more structured data variables included in submissions. On the data analytics side of things, once posts are tagged, one would be able to filter on posts that pertain to a certain tag. For example, one might want to only see posts and trends that had to do with a child's school time. In this case, they might filter on the *school* tag.

Milestones also serve as one of AMP's structured data types. Milestones are very similar to tags, but differ in the fact that once a milestone has been attached to a post, that milestone may never be selected again, because it has been completed. These serve as child goals in the AMP system. With this information, a parent may be able to see what events or submissions led up to a child meeting a certain milestone, such as making eye contact or communicating emotions effectively.

5.3.2 Multimedia

Images, videos, and audio recordings can also be included in AMP submissions. As of this point in our research, this type of media serves as unstructured data. Other than the fact of whether an image, video, or audio recording was included in a post or not, there is no alternative filtering for these items, and the multimedia mostly only serves the purpose of viewing pleasure for the parent. These types of media can be attached either from the feed screen or from the submission screen.

With this type of multimedia, parents can scroll through the feed, viewing, watching, and listening to items that have been posted about that child. On our data analytics platform, one can filter on items that have a multimedia attachment, but we do not currently do any sort of signal processing to determine trends in the image, video or audio streams.

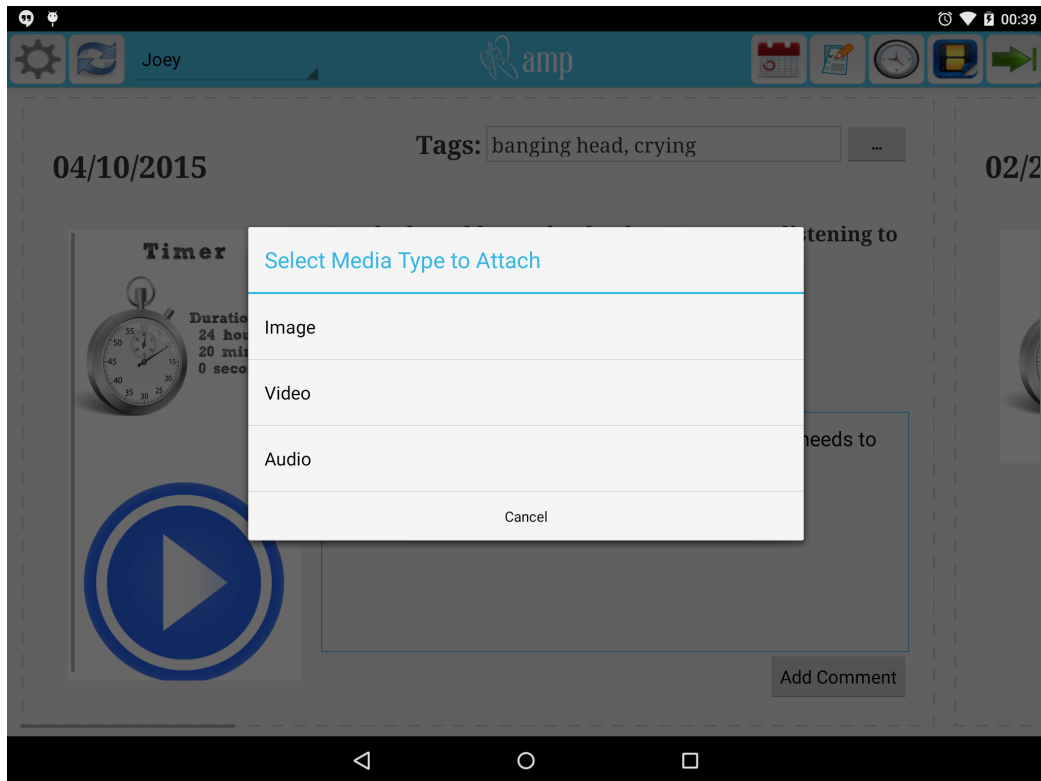


Figure 5.6: Media Submission Options

5.3.3 Forms and Checklists

AMP also allows for forms and checklists to be submitted. Each child in the AMP system has a set number of forms or checklists that can be submitted for them. Each form can have any number of multiple choice or free response questions that can be filled out by a parent. Often times, these questions are about the child's progress, and questions require typical "yes, no, sometimes" type answers.

When a form is attached to a submission, a comparative score is calculated on our back end, allowing parents, physicians, or therapists to compare scores with previous ones, and see what may have led to either progress or decline. Forms can be filled out by tapping the form button on the feed screen. An example form is shown in figure 5.7.

The screenshot shows a mobile application interface for 'Autism Feedback'. The title bar is blue with the app's logo. Below it, the main content area is white and contains a checklist titled 'Filling out the "CSBS DP Infant-Toddler Checklist"'. The checklist consists of six questions, each followed by a dropdown menu. The questions and their current selections are: 1. 'Do you know when your child is happy and when your child is upset?' (Not Yet), 2. 'When your child plays with toys, does he/she look at you to see if you are watching?' (Sometimes), 3. 'Does your child smile or laugh while looking at you?' (Sometimes), 4. 'When you look at and point to a toy across the room, does your child look at it?' (Often), 5. 'Does your child let you know that he/she needs help or wants an object out of reach?' (Sometimes), 6. 'When you are not paying attention to ...' (Not Yet). A 'Submit' button is located at the bottom of the checklist. The bottom of the screen shows a black navigation bar with three icons: a back arrow, a home icon, and a list icon. The top right corner of the screen shows the time '22:46' and a battery icon.

Figure 5.7: AMP Checklist Example

5.3.4 Timers

Timers are another good form of structured data that can be included in submissions. Timers are meant to be very general, but were initially thought of as tantrum timers, allowing a parent to include the length of a tantrum in their submission. Timers can be attached to a submission in two different ways. A user can tap the timer button on the main screen to begin recording a timer on the spot, as shown in figure 5.8, or a timer with a manual set length can be set while in the submission screen.

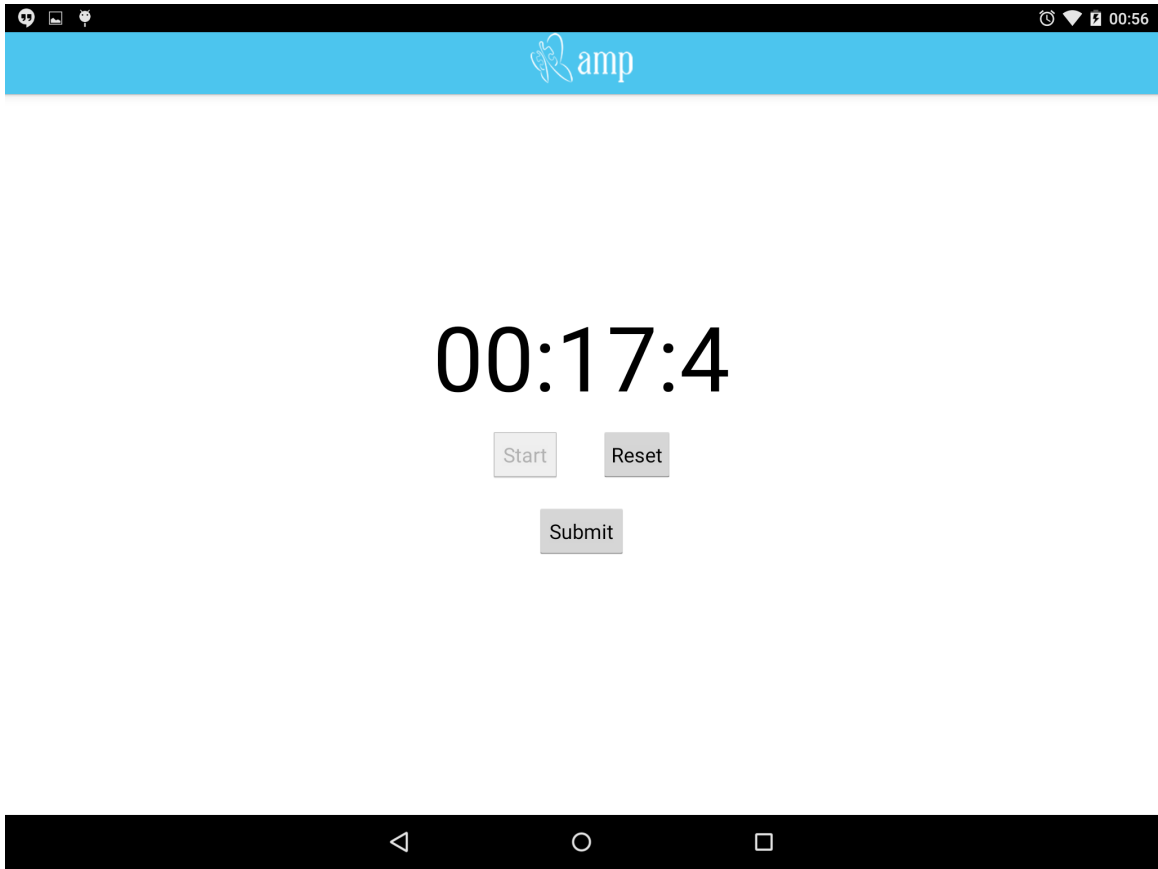


Figure 5.8: Timer Screen

Since timer data is structured, a user can use tantrum length as a dependent variable when looking at graphs on our data analytics platform. A parent can see, for example, how tantrum lengths have increased or decreased over time, and which factors have perhaps caused the variations.

5.3.5 Events

Events are one of the most recent additions to AMP and are also perfect examples of how well AMP's mobile application is a platform for new features. As a submission attachment, a parent can create a daily, weekly, monthly, or one time event for their child. Events include a recurrence type, start/end dates, and a title. Recurring events

show up in the feed, and also serve as a common access point for a few integrations that will be discussed later in this thesis.

A child’s schedule can also be changed from the AMP mobile application. A parent can filter on daily, weekly, monthly, or one time events and change them accordingly.

Schedule changes often spark tension in the lives of children with social disorders. With record of when a child’s schedule was changed, AMP’s data analytics platform can correlate schedule changes with other variables in the system, like tantrum length for example. The data reflects that this is the most common case; as schedule changes increase, tantrum lengths increase.

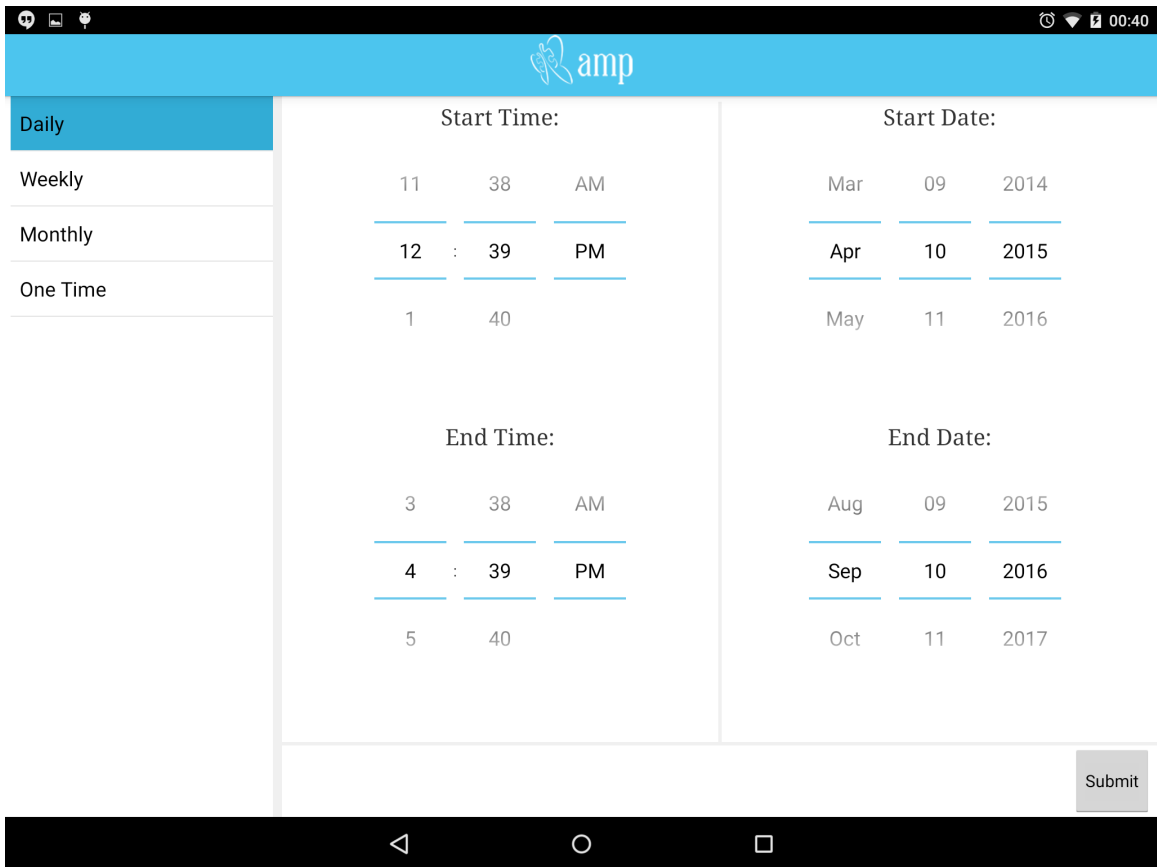


Figure 5.9: Add Event Screen

5.4 The Feed: Viewing Events and Information

Posting events and information is only part of AMP's total functionality. Parents may also want to view submissions posted about their child. Like posting, a parent can view information posted about any child that they are authorized to view. AMP's mobile application show posted submissions in a feed-like, horizontal scrolling view. Any submission posted about a certain child will show up in a child's feed. This means that if both a parent and teacher are authorized to view a child, the parent will see submissions posted by the teacher, and vice versa. Users can also switch to viewing other children's feeds by selecting from a drop-down menu of those they are authorized to manage.

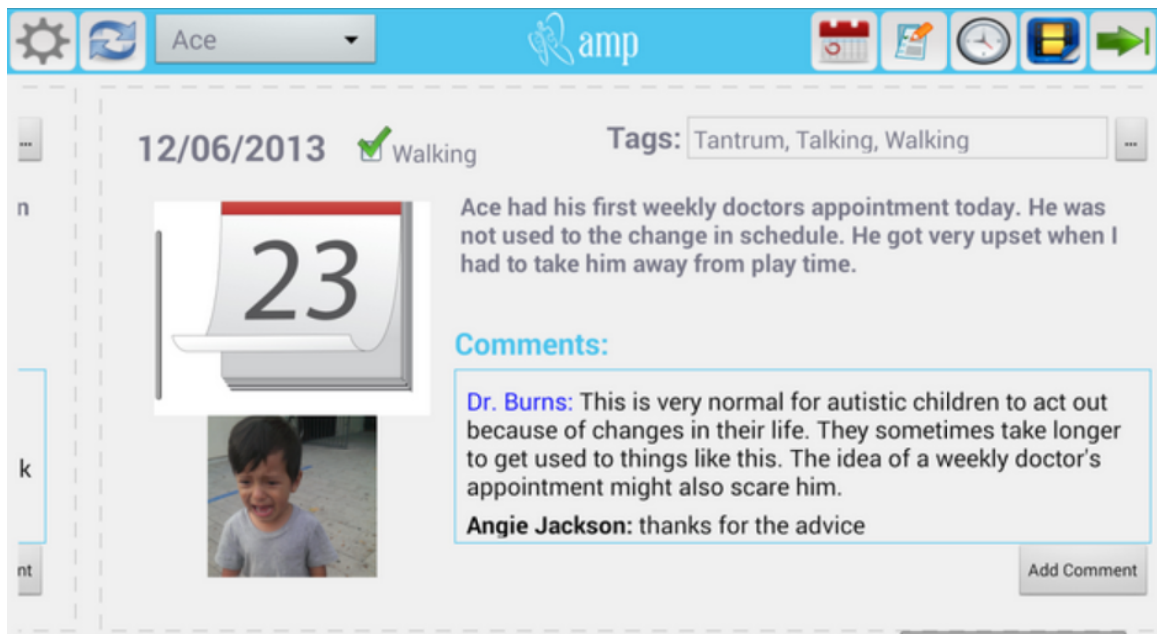


Figure 5.10: Feed Screen (Mobile)

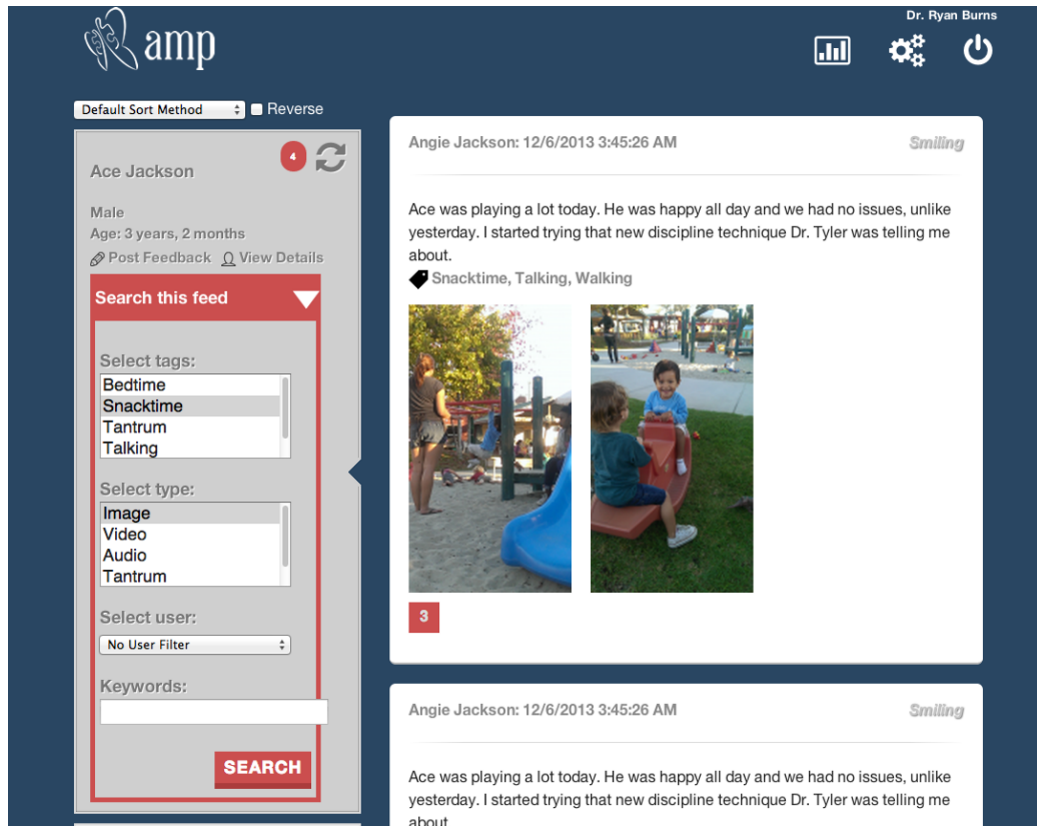


Figure 5.11: Filterable Feed Screen (Web)

Submission items in the feed contain a number of things including the posted date, description, tags, milestones, attachments, and comments. Attachments are shown in a vertical scrolling view within the submission item view. Attachments can include expandable images, playable videos/audio recordings, and info-graphics for created events and timers.

While viewing a child's feed, users of AMP can also comment on submission items. Comments are displayed in a vertical scrolling view within each submission and contain a list of comments pertaining to that submission. Therefore parents, physicians, teachers, and therapists can all communicate about certain events or behaviors that occur in a child's life. Commenting on submissions makes it so posting information is no longer one way, and involves everyone in the circle.

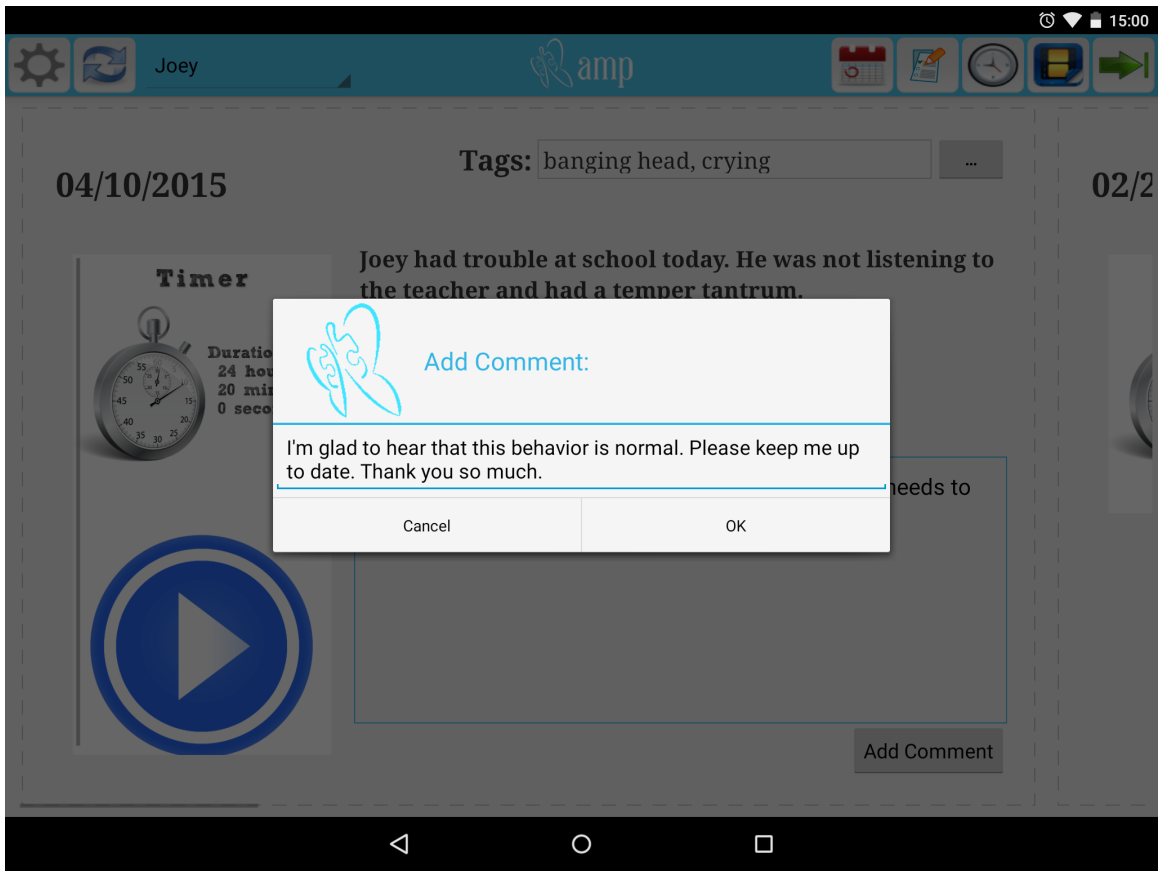


Figure 5.12: Commenting on a Submission

Chapter 6

Experimental User Trials

As the platform came to fruition, we began to seek ways to get AMP into the hands of real people. We knew that we wanted this study to be closed; we weren't by any means planning on releasing our application to the Android application store. After presenting ideas to people in both medical and educational fields, we found that it was much more feasible to do user studies in an education setting.

After a local news article on the AMP research group, we were contacted by a teacher at Edison High School in Huntington Beach, CA who was interested in trying out AMP for their Special Abilities Cluster (SAC) for a short three month period of time. We eagerly agreed, and immediately began working on logistics of the trial.

6.1 Trial 1: User Interface Evaluation

In our first trial, the primary goal was to evaluate whether the user interface was usable in a real-life environment. Often times, software engineers have trouble assess-

ing things like user interface and experience, especially if they are the engineers who created the product. Along with helping the SAC program, this user trial would also provide needed feedback on the application's user experience.

6.1.1 Pre-trial Development

After initially presenting AMP to the SAC program at Edison High School, the administrators had a few modifications in mind. Being so eager to conduct user studies, we were willing to take on the work.

Although they were impressed by the abundance of functionality in AMP, they first wanted a reduced set of features, as many did not apply to their desired application. Specifically, support for forms, milestones, and events would be removed from the application. A replacement for forms and milestones will be mentioned later, in the discussion of trial 2. This task was completed by removing buttons for forms and events from the feed screen, and removing the milestone section from the submission screen.

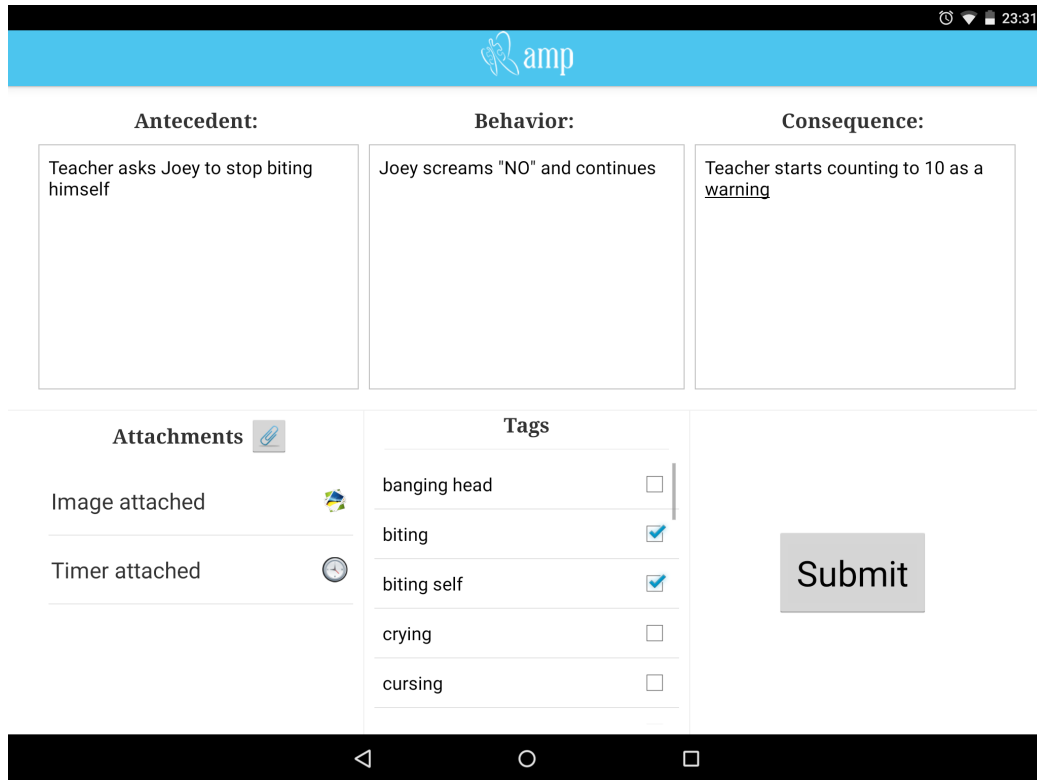


Figure 6.1: ABC Submission Screen

Administrators in the SAC program also wanted to expand and organize submission descriptions with the implementation of Antecedent-Behavior-Consequence (ABC) data. A paper titled “Classroom behavior management: A dozen common mistakes and what to do instead” addresses the fact that simply recording a child’s misbehavior is not enough, and that ABC data allows a caregiver to further understand external factors, including what caused the misbehavior and what the outcome was [4]. Implementing this involved much more refactoring to the submission screen, as depicted in figure 6.1. ABC data would be submitted as plain text, just like a typical description would be, but now data on the back end would be able to be filtered by antecedent, behavior, or consequence. Displaying this on AMP’s mobile application simply involved splitting a description into the 3 ABC parts, as shown in figure 6.2.



Figure 6.2: Feed Screen with ABC

6.1.2 Setup and Logistics

The trial involved a total of ten teachers or aides, who would each use AMP to manage behaviors of one child in the class. Ten Google Nexus 7 tablets were purchase, rooted, and stripped of any unnecessary software before use. Tablets were to be used for AMP purposes only, and would most likely remain in the classroom.

User accounts and child profiles were created for each subject in the study. No personal information would be recorded. Aides used unique identifiers for their user IDs, and child profiles were created with code names for the children, only including the first two letters of their first name and the first two letters of their last name. The tablets were loaded, logged in and ready to go, equipped with chargers and thick silicon cases for drop and scratch protection.



Figure 6.3: Tablets Ready for Trial 1

6.1.3 Training and Oversight

A few days prior to delivering the tablets, we sent out a pre-trial user survey to all of the teachers and aides participating in the trial, asking various questions about how they currently recorded behavior data. The questions are shown in figures 1 and 2.

Upon arriving at Edison High with the tablets ready for our first trial, we gave a comprehensive presentation and training to the ten teachers and aides who would be using AMP. They eagerly accepted the changes and were quick to learn about the system. Once all tablets were on the wireless network, they were ready to go.

Oversight and maintenance was not a problem during the trial. With the help of the faculty at Edison SAC, everything went very smoothly. Tablets were collected at the end of the three month period, post survey questions were released. Post survey questions are shown in figures 3 and 4.

6.2 Trial 2: Specific Integration: AMP as a Platform

Trial one gave us positive insight that AMP could in fact be used by real users, and for a good reason. The following academic semester, Edison’s SAC program lead asked us if we wanted to do a second user trial. Again, we did not hesitate. In trial 2, we wanted to test whether AMP could adapt to our subject’s use case. AMP was designed to be this flexible; we wanted to see if it could stand it’s ground. We asked administrators what they would like AMP to do for their specific integration. Along with general feedback about the platform, participants told us that they’ve always wanted to merge technology with their process of tracking something called Individual Education Plans.

6.2.1 Individual Education Plan (IEP) Goals

In special education, IEPs serve as standards in every child’s education. Specifically, they are binding commitments of resources defined by measurable goals that a certain school district must provide to meet a child’s needs dependent on their particular disability [12]. AMP’s integration of IEP’s is only briefly discussed in this thesis, but is explored in depth in a parallel thesis titled “Using Technology to Assist the Individualized Education Program for Children with Autism Spectrum Disorder” [11].

6.2.2 Pre-trial Development and New Features

The most prevalent feedback that we received from the previous trial was that teachers and aides often liked taking tablets outside with their kids, and would like to be able to post when not connected to any network. One way we could have done this would have been to give them LTE enabled devices; that way they wouldn't need to be connected to a WiFi network at all times. This option turned out to be too expensive. The alternative was to build offline submission posting into our application. This meant that if a user posted while offline, it would be queued in a SQLite local database on the device and then posted once network connectivity was available. Offline posting didn't only involve storing submissions for offline use, but also involved storing profiles, tags, descriptions, attachments, and soon to be implemented IEP goals for each child.

Our next task was to integrate IEP goals with AMP. The use case was this - teachers and aides can associate certain AMP submissions with an IEP goal associated to that child. This association includes a goal name, a completion percentage, and a type such as physical, verbal, hand over hand (HOH), or modeling. The teacher or aide would later be able to log into the web client to manage those goals, or mark them as complete.

The addition of IEP goals involved API, web client, and mobile application changes. In order to do the UI implementation, we first needed to have the application pull and store IEP goals from the API. Each goal object includes a name, description, status (in progress or complete), completion percentage, and type. After goals were storing correctly, all we needed to do was add the UI to associate goals with submissions. UI implementation is depicted in 6.4. Once a user finishes filling out the submission form, they are prompted to optionally associate with an IEP goal.

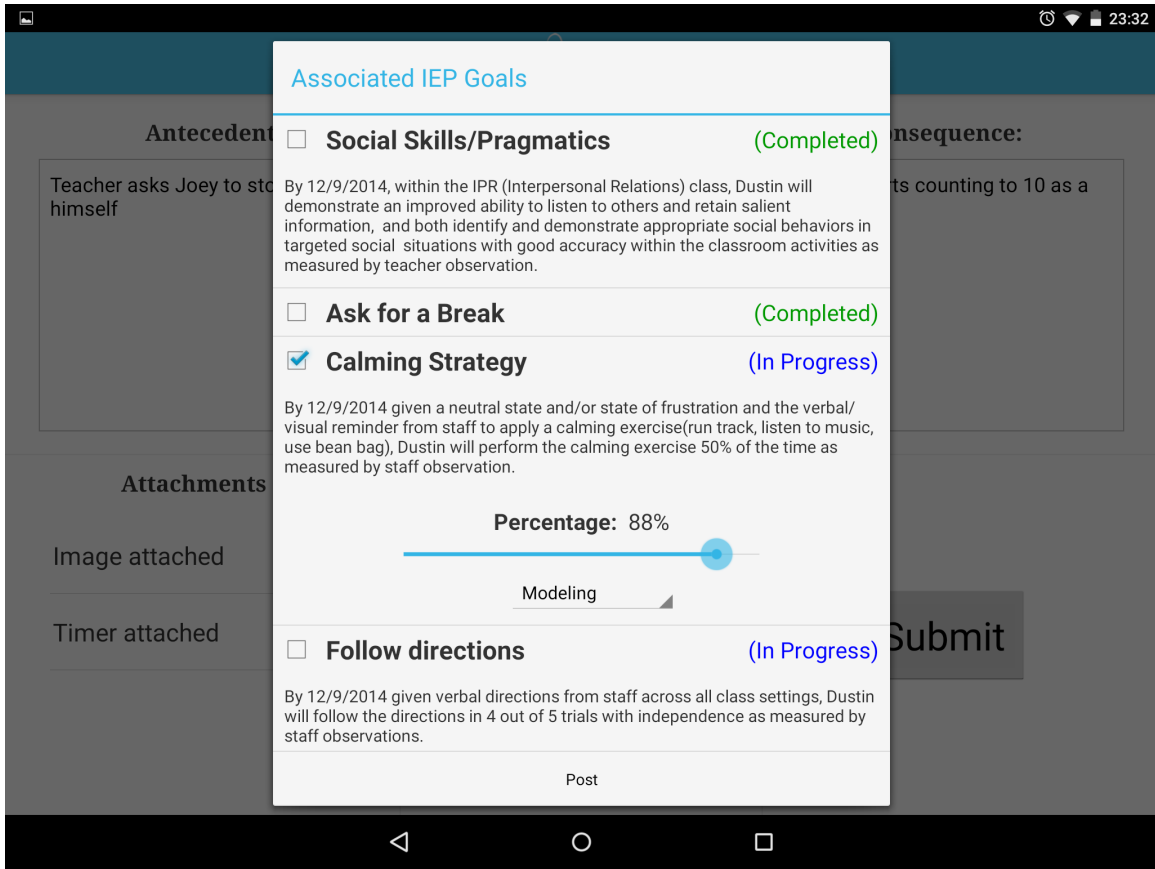


Figure 6.4: IEP Association UI

6.2.3 Setup, Training, and Oversight

Setup for our second user trial was very similar to the first. The trial would again involve ten tablets and have a three month duration. This time, there would be ten users, but some were to manage more than one student. Before arriving at Edison High School, all we needed to do was load the ten tablets with their corresponding users and student profiles. Training would also be very similar. We did formal training to the ten new teachers and aides who were to use the application, but this time it also included aspects of the IEP integration as well.

Pre-trial surveys were again sent out to teachers and aides. These are displayed in figures 5, 6 and 7.

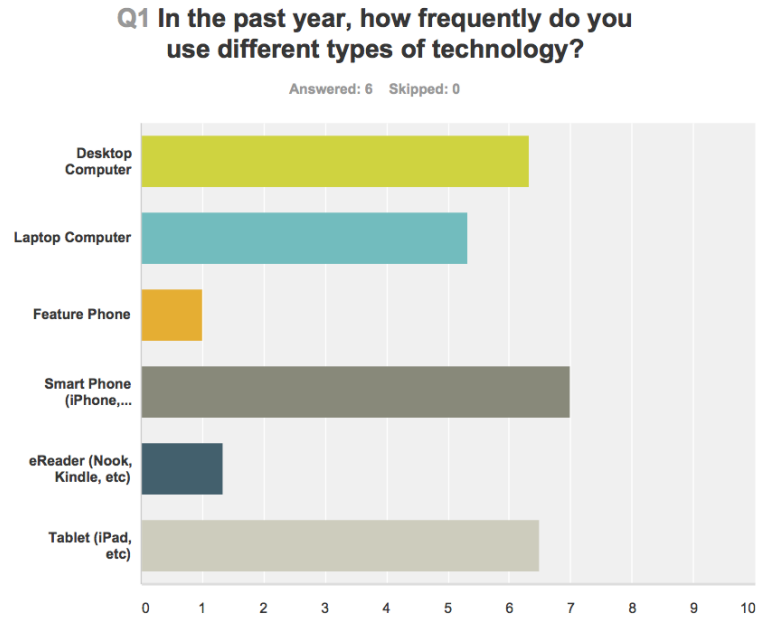
Again, everything went very smoothly. At the end of the trial, tablets were collected and post survey questions were released. Post survey questions are shown in figures 8 and 9.

Chapter 7

Analysis of Trial Results

7.1 Trial 1: User Interface Evaluation

7.1.1 Pre-trial Responses

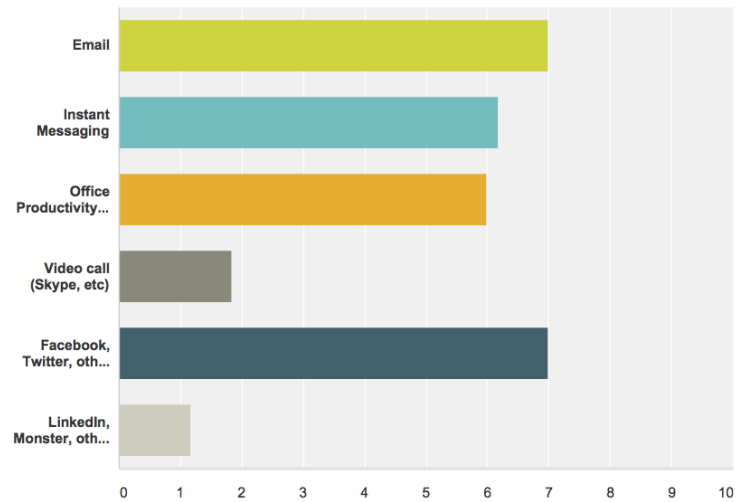


	Never	About once a Month	A few times a Month	About once a Week	A few times a Week	About once a Day	Everyday	Total	Weighted Average
Desktop Computer	0.00% 0	0.00% 0	0.00% 0	0.00% 0	33.33% 2	0.00% 0	66.67% 4	6	6.33
Laptop Computer	16.67% 1	0.00% 0	0.00% 0	16.67% 1	0.00% 0	16.67% 1	50.00% 3	6	5.33
Feature Phone	100.00% 6	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	6	1.00
Smart Phone (iPhone, Android, etc)	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	100.00% 6	6	7.00
eReader (Nook, Kindle, etc)	66.67% 4	33.33% 2	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	6	1.33
Tablet (iPad, etc)	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	50.00% 3	50.00% 3	6	6.50

Figure 7.1: Pre-trial Survey 1 (Response 1)

Q2 In the past year, how frequently do you use different features or services?

Answered: 6 Skipped: 0

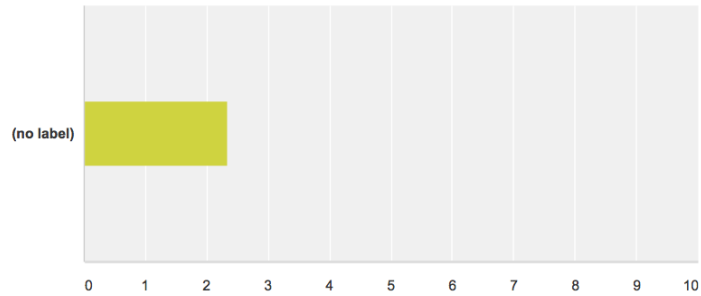


	Never	About once a Month	A few times a Month	About once a Week	A few times a Week	About once a Day	Everyday	Total	Weighted Average
Email	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	100.00% 6	6	7.00
Instant Messaging	0.00% 0	0.00% 0	16.67% 1	0.00% 0	0.00% 0	16.67% 1	66.67% 4	6	6.17
Office Productivity (Word, Powerpoint, etc)	0.00% 0	0.00% 0	0.00% 0	0.00% 0	50.00% 3	0.00% 0	50.00% 3	6	6.00
Video call (Skype, etc)	66.67% 4	0.00% 0	16.67% 1	16.67% 1	0.00% 0	0.00% 0	0.00% 0	6	1.83
Facebook, Twitter, other Social Media	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	100.00% 6	6	7.00
LinkedIn, Monster, other Career Tools	83.33% 5	16.67% 1	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	6	1.17

Figure 7.2: Pre-trial Survey 1 (Response 2)

Q3 Given the current available technology, how well do you feel it is being used to support education and child development?

Answered: 6 Skipped: 0

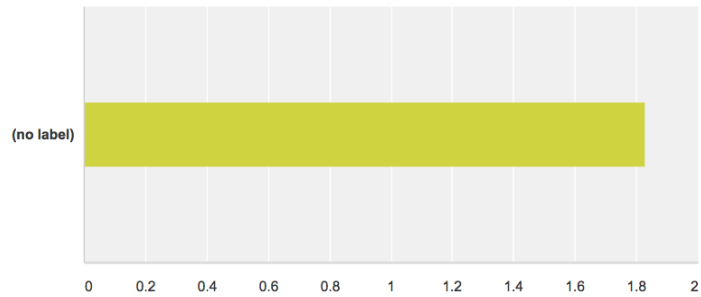


	Not well	Marginally well	Well	Extremely well	Total	Weighted Average
(no label)	16.67% 1	50.00% 3	16.67% 1	16.67% 1	6	2.33

Figure 7.3: Pre-trial Survey 1 (Response 3)

Q4 Given the current available technology, how well do you feel it is being used to share data and communicate with educators and health care providers?

Answered: 6 Skipped: 0

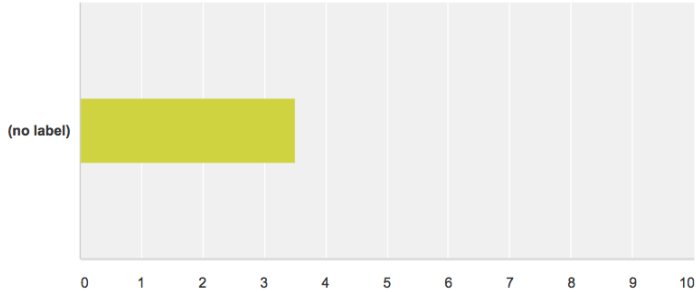


	Not well	Marginally well	Well	Extremely well	Total	Weighted Average
(no label)	33.33% 2	50.00% 3	16.67% 1	0.00% 0	6	1.83

Figure 7.4: Pre-trial Survey 1 (Response 4)

Q7 How interested would you be in a system to improve communication and data sharing between educators and health care providers in support of special education?

Answered: 6 Skipped: 0



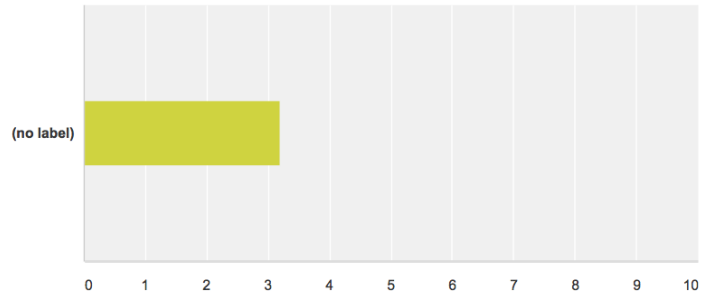
	Not interested	Somewhat interested	Interested	Very interested	Total	Weighted Average
(no label)	0.00% 0	0.00% 0	50.00% 3	50.00% 3	6	3.50

Figure 7.5: Pre-trial Survey 1 (Response 7)

7.1.2 Post-trial Responses

Q1 Given your experience with AMP, how well do you feel it improves data sharing and communication with educators and health care providers in the context of education?

Answered: 5 Skipped: 0

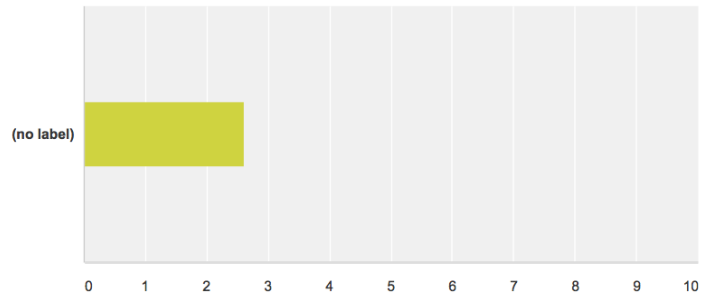


	Not well	Marginally well	Well	Extremely well	Total	Weighted Average
(no label)	0.00% 0	20.00% 1	40.00% 2	40.00% 2	5	3.20

Figure 7.6: Post-trial Survey 1 (Response 1)

Q3 Based on your experience with AMP, how convenient was the system to use?

Answered: 5 Skipped: 0

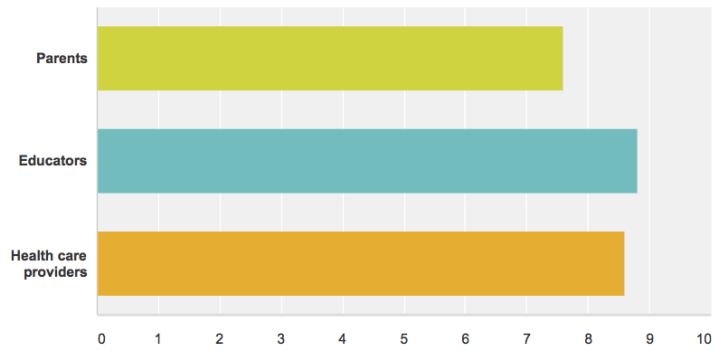


	Not convenient	Somewhat convenient	Convenient	Very convenient	Total	Weighted Average
(no label)	20.00% 1	20.00% 1	40.00% 2	20.00% 1	5	2.60

Figure 7.7: Post-trial Survey 1 (Response 3)

Q6 On a scale from 1 to 10 how likely are you to recommend AMP to ...

Answered: 5 Skipped: 0

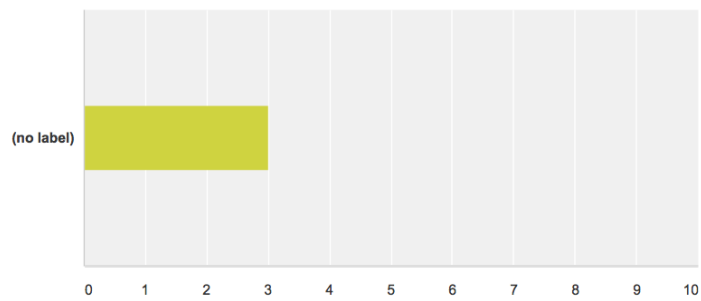


	1	2	3	4	5	6	7	8	9	10	Total	Weighted Average
Parents	0.00% 0	0.00% 0	0.00% 0	0.00% 0	20.00% 1	0.00% 0	40.00% 2	0.00% 0	20.00% 1	20.00% 1	5	7.60
Educators	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	20.00% 1	20.00% 1	20.00% 1	40.00% 2	5	8.80
Health care providers	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	20.00% 1	20.00% 1	40.00% 2	20.00% 1	5	8.60

Figure 7.8: Post-trial Survey 1 (Response 6)

Q7 Given your experience with AMP, did you find the user interface easy to use?

Answered: 5 Skipped: 0



	Not easy	Marginally easy	Easy	Extremely easy	Total	Weighted Average
(no label)	0.00% 0	20.00% 1	60.00% 3	20.00% 1	5	3.00

Figure 7.9: Post-trial Survey 1 (Response 7)

7.1.3 Discussion

Our first trial's primary purpose was to evaluate whether AMP's user interface could actually be used in the field of special education. Questions presented in surveys are geared toward that purpose.

In our pre-trial survey, we asked questions mostly pertaining to the frequency of use of certain technology before the trial began. Questions 1 and 2 ask teachers/aides how frequently they use different types of technology, including computers, smart phones, social networks, video calling services etc. Responses for this question clearly showed that we were dealing with a fairly tech-savvy group; they had all used up-to-date technology nearly every day. Question 3 asks survey takers to rate how well current technology addresses education and child development. Responses for this averaged a 2.33 out of 5, coming in at response "Marginally Well." This is what we expected and hoped to change by the end of the trial. Question 4 asks the same, but about health care providers instead of educators. The next question asked for a free response about frustrations with current technologies used in education. Most of our responses showed that current technologies are very local, meaning that it is very rare that communication between caretakers is placed in the center of everything. These responses also showed that current technologies are frustrating because they are not user friendly, and developers did not design with usability in mind. Question 6 asked about which features would be most useful in a software solution that addressed this problem. Responses to this question showed desire for two things: a way to look at trends in data, and a better way to communicate with other caretakers. The last question on this survey showed that survey takers were very interested and open-minded to using a system like ours.

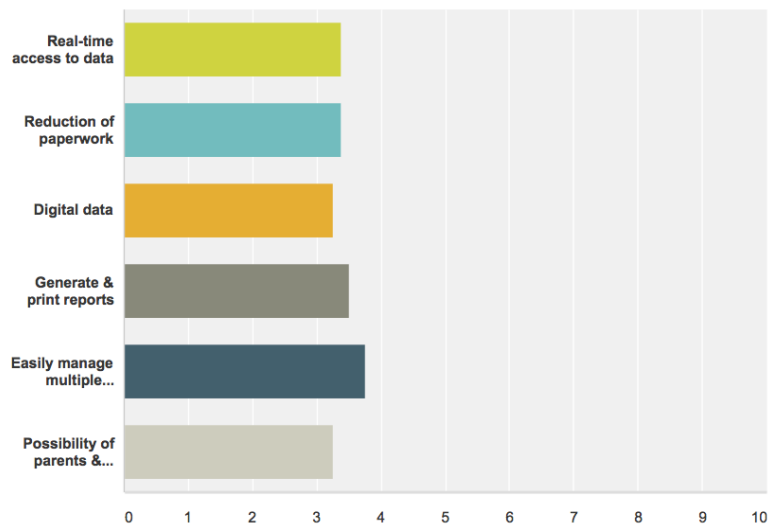
In the post-trial survey, we asked mostly questions about their experiences with AMP for the three months they had been using it. Question 1 asks how well AMP promotes and improves communication among educators. Results came in at a 3.2 out of 5, showing that it does in fact improve communication, even if only by a small amount. The second survey question asks about the features of AMP, specifically which were most useful. The two primary responses to this question were the simplicity of the application in general, and the pre-set behavior check boxes (what we call tags). These responses showed that we really did accomplish a large overarching goal: to make the system easy and enjoyable to use. Question 3 asks how convenient the system was to use. Responses were not what we expected them to be, weighing in at a short 2.6 out of 5. We figured that this was mostly due to the fact that offline submission posting was not available. Question 5 asks if AMP properly addresses the lack of technology in communication with other educators. Most people answered that it is a good start, but has a long way to go. We agree with that, and one of our goals was to start fixing a problem, not necessarily to fix it entirely. The next question asks the typical “Net Promoter Score” question: “How likely are you to recommend AMP to others?” Responses show an average of 8.3 out of 10, a score we are extremely happy with. Question 7 asks about how easy AMP was to use. We were happy that responses averaged about a 3 out of 5, resulting in a response of “Easy.” The last question asks which features survey takers would like to see added to AMP in the future. Certain responses dominated answers to this question: the addition of offline submissions, and the integration of Individual Education Plans. As stated in chapter 5, these responses led the way to pre-trial development in trial 2.

7.2 Trial 2: Specific Integration: AMP as a Platform

7.2.1 Pre-trial Responses

Q7 In an ideal IEP system, how important would the following features be to you?

Answered: 8 Skipped: 1



	Not Important	Somewhat important	Important	Very important	N/A	Total	Weighted Average
Real-time access to data	12.50% 1	0.00% 0	25.00% 2	62.50% 5	0.00% 0	8	3.38
Reduction of paperwork	0.00% 0	25.00% 2	12.50% 1	62.50% 5	0.00% 0	8	3.38
Digital data	0.00% 0	25.00% 2	25.00% 2	50.00% 4	0.00% 0	8	3.25
Generate & print reports	0.00% 0	0.00% 0	50.00% 4	50.00% 4	0.00% 0	8	3.50
Easily manage multiple students' progress	0.00% 0	0.00% 0	25.00% 2	75.00% 6	0.00% 0	8	3.75
Possibility of parents & teachers using the same system	0.00% 0	12.50% 1	50.00% 4	37.50% 3	0.00% 0	8	3.25

Figure 7.10: Pre-trial Survey 2 (Response 7)

Q8 How frustrating are the following aspects of the current IEP process?

Answered: 8 Skipped: 1

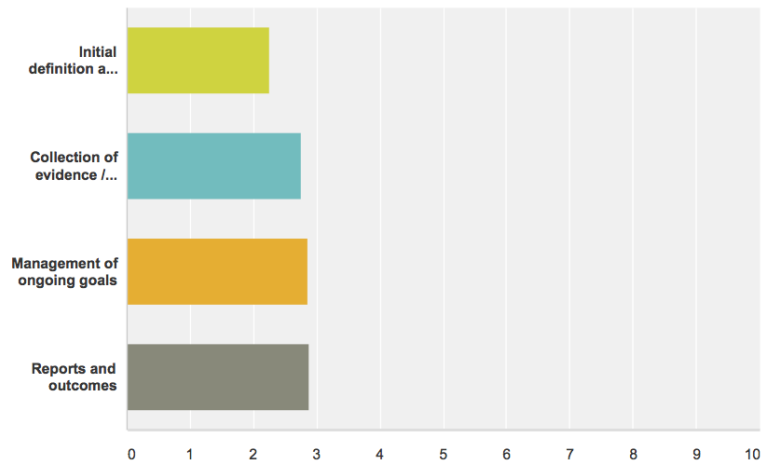


Figure 7.11: Pre-trial Survey 2 (Response 8)

Q9 To what extent is technology currently used for IEP forms? Are there any challenges with the current IEP forms?

Answered: 7 Skipped: 2

#	Responses	Date
1	All responses are recorded on the computer	2/24/2015 10:19 AM
2	online IEP program	2/24/2015 7:51 AM
3	We use SEIS program. No challenges at this time.	2/23/2015 7:54 PM
4	computers are used to input data from paper copies and teacher observations.	2/23/2015 1:23 PM
5	Online editing.	2/23/2015 11:36 AM
6	all of our IEPs are online through the SEIS system. I am currently taking data by hand then transferring it over into an online format.	2/23/2015 10:43 AM
7	Use of computers to create, update and modify IEP's.	2/23/2015 9:23 AM

Figure 7.12: Pre-trial Survey 2 (Response 9)

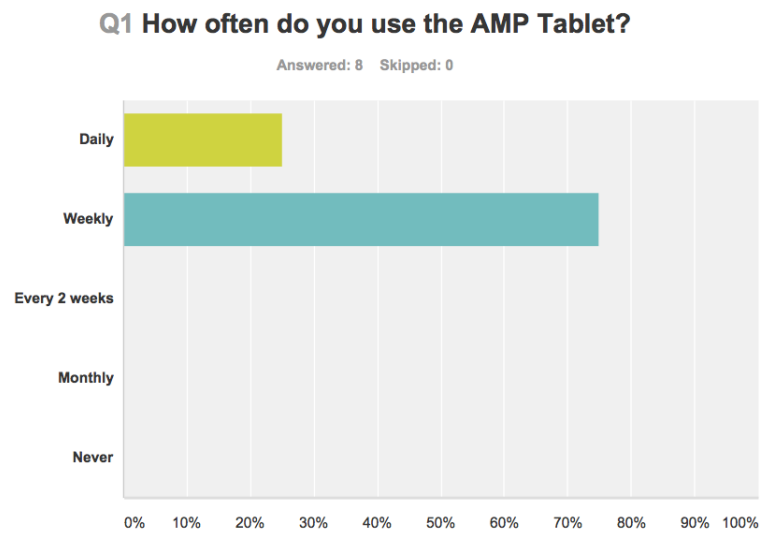
Q10 If you could improve one aspect of the IEP system, what would it be, and how would you improve it?

Answered: 8 Skipped: 1

#	Responses	Date
1	Quarterly reporting is difficult	2/24/2015 10:19 AM
2	tracking of goals from teacher to teacher	2/24/2015 7:51 AM
3	None at this time	2/23/2015 7:54 PM
4	customizable data tracking attached to the students IEP and easily be able to be used across platform in order to have touch screen data collection capabilities from a tablet.	2/23/2015 1:23 PM
5	A better and more cohesive system for collecting data. If all teachers had 1-3 different forms to collect the data it would be easier to see progress on goals.	2/23/2015 11:58 AM
6	Data collection that is easy to implement and record.	2/23/2015 11:36 AM
7	More objective ways to monitor and report progress.	2/23/2015 10:43 AM
8	Ease of data collection...going paperless!	2/23/2015 9:23 AM

Figure 7.13: Pre-trial Survey 2 (Response 10)

7.2.2 Post-trial Responses

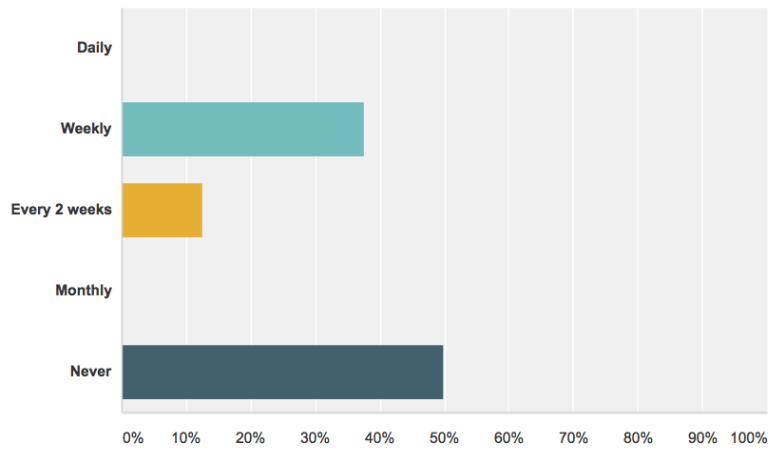


Answer Choices	Responses
Daily	25.00% 2
Weekly	75.00% 6
Every 2 weeks	0.00% 0
Monthly	0.00% 0
Never	0.00% 0
Total	8

Figure 7.14: Post-trial Survey 2 (Response 1)

Q2 How often do you use the AMP Website?

Answered: 8 Skipped: 0

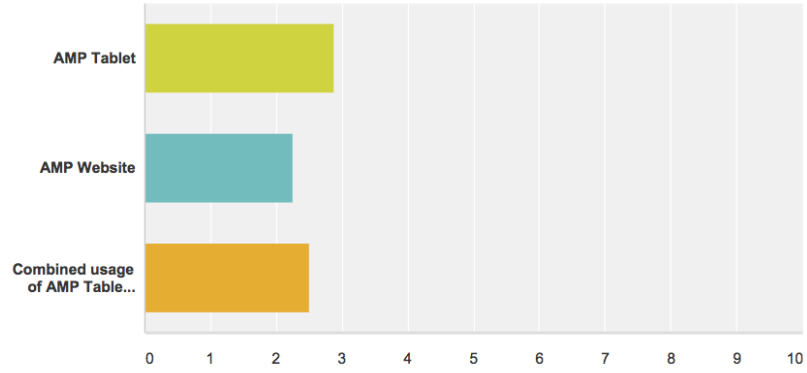


Answer Choices	Responses	
Daily	0.00%	0
Weekly	37.50%	3
Every 2 weeks	12.50%	1
Monthly	0.00%	0
Never	50.00%	4
Total		8

Figure 7.15: Post-trial Survey 2 (Response 2)

Q3 Given your experience with AMP, how well did these components improve the IEP process?

Answered: 8 Skipped: 0

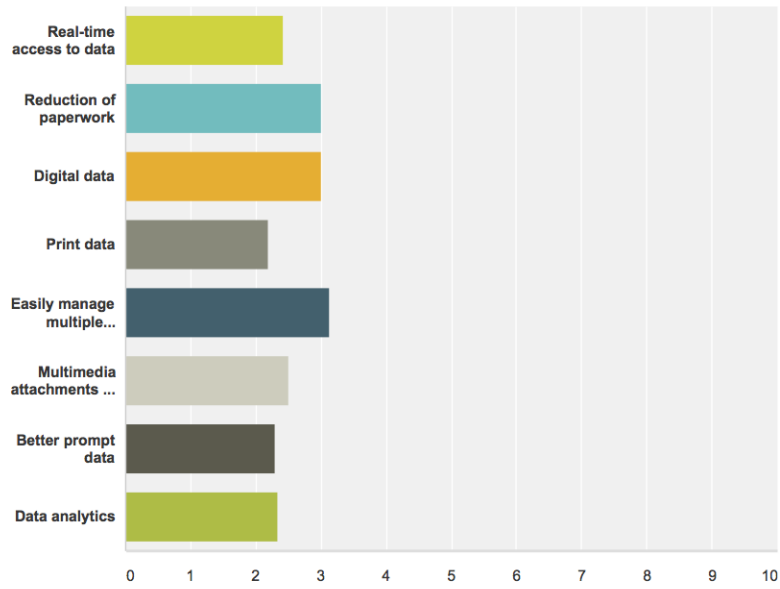


	Not well	Marginally well	Well	Extremely well	N/A	Total	Weighted Average
AMP Tablet	12.50% 1	12.50% 1	50.00% 4	25.00% 2	0.00% 0	8	2.88
AMP Website	0.00% 0	37.50% 3	12.50% 1	0.00% 0	50.00% 4	8	2.25
Combined usage of AMP Tablet & Website	0.00% 0	25.00% 2	25.00% 2	0.00% 0	50.00% 4	8	2.50

Figure 7.16: Post-trial Survey 2 (Response 3)

Q4 In your opinion, how well did AMP with the new IEP features support these areas:

Answered: 8 Skipped: 0



	Not well	Marginally well	Well	Extremely well	N/A	Total	Weighted Average
Real-time access to data	25.00% 2	12.50% 1	37.50% 3	12.50% 1	12.50% 1	8	2.43
Reduction of paperwork	0.00% 0	12.50% 1	62.50% 5	12.50% 1	12.50% 1	8	3.00
Digital data	12.50% 1	0.00% 0	50.00% 4	25.00% 2	12.50% 1	8	3.00
Print data	12.50% 1	25.00% 2	25.00% 2	0.00% 0	37.50% 3	8	2.20
Easily manage multiple students' progress	0.00% 0	12.50% 1	50.00% 4	25.00% 2	12.50% 1	8	3.14
Multimedia attachments to IEP goals	12.50% 1	25.00% 2	25.00% 2	12.50% 1	25.00% 2	8	2.50
Better prompt data	0.00% 0	62.50% 5	25.00% 2	0.00% 0	12.50% 1	8	2.29
Data analytics	12.50% 1	25.00% 2	37.50% 3	0.00% 0	25.00% 2	8	2.33

Figure 7.17: Post-trial Survey 2 (Response 4)

Q5 What features of AMP did you find most useful?

Answered: 8 Skipped: 0

#	Responses	Date
1	Quick input of student behavior. Reading and inputting progress toward behavior goals.	4/28/2015 10:26 AM
2	I was able to keep my data on a small hand held device, rather than needing several folders.	4/28/2015 7:56 AM
3	Easy and user friendly	4/27/2015 7:52 PM
4	multimedia attachments and data analytics	4/27/2015 3:08 PM
5	Being able to quickly access and input IEP goal data without having to type to input data.	4/27/2015 11:39 AM
6	ability to input behaviors in as they occur	4/23/2015 2:22 PM
7	The tablet is user friendly.	4/23/2015 2:07 PM
8	Attaching media	4/23/2015 1:12 PM

Figure 7.18: Post-trial Survey 2 (Response 5)

Q6 What did you find most frustrating about AMP?

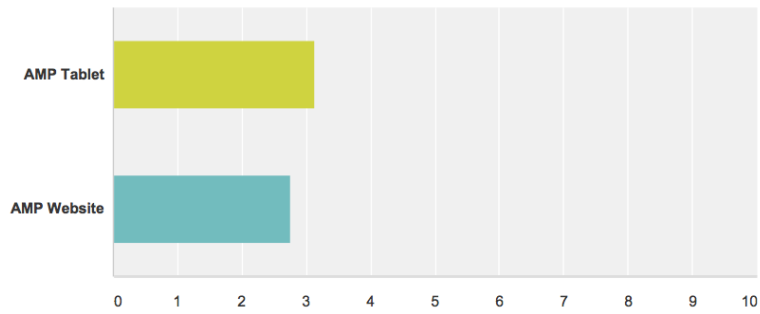
Answered: 7 Skipped: 1

#	Responses	Date
1	Linking up to wi-fi. The signal is not good in my room and sometimes needed to be restarted to link up.	4/28/2015 10:26 AM
2	It took longer to type into the tablet then writing in the folders. The software layout in relation to percentages and prompts section were not exactly how I would lay out the system to fit my class data keeping.	4/28/2015 7:56 AM
3	a feature to turn off the real time stamp.	4/27/2015 3:08 PM
4	Having to do data entry that requires typing on a tablet. Having to go through the behavior screen to get to the IEP goal data entry page. Only having one type of input data for IEP goals (The slider with percentages) we should have options of different ways/formats to input performance data. e.g.- checkboxes, multiple choice, percentages, yes/no, etc. these will vary based on the language of the goal. There should be an option to select the type of data you wish to enter. Not just a slider bar.	4/27/2015 11:39 AM
5	issues with linking up, monitoring where the AMP is, etc	4/23/2015 2:22 PM
6	When not recording a specific behavior not really sure of what the data is tracking.	4/23/2015 2:07 PM
7	Would not turn on without wifi	4/23/2015 1:12 PM

Figure 7.19: Post-trial Survey 2 (Response 6)

Q7 Given your experience with AMP, did you find the user interface easy to use?

Answered: 8 Skipped: 0

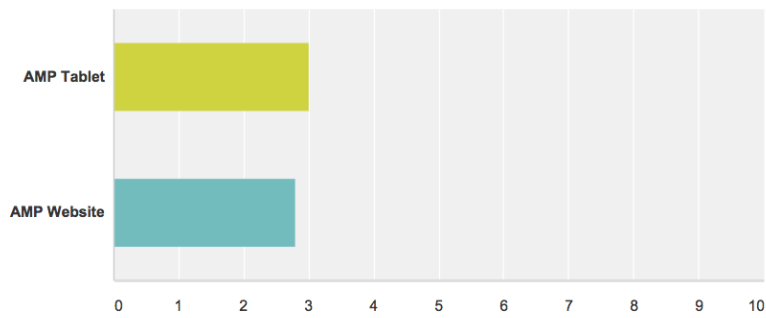


	Not easy	Marginally easy	Easy	Very easy	N/A	Total	Weighted Average
AMP Tablet	0.00% 0	25.00% 2	37.50% 3	37.50% 3	0.00% 0	8	3.13
AMP Website	0.00% 0	25.00% 2	12.50% 1	12.50% 1	50.00% 4	8	2.75

Figure 7.20: Post-trial Survey 2 (Response 7)

Q8 How friendly was the user interface?

Answered: 8 Skipped: 0



	Not friendly	Slightly friendly	Friendly	Very friendly	Total	Weighted Average
AMP Tablet	0.00% 0	25.00% 2	50.00% 4	25.00% 2	8	3.00
AMP Website	0.00% 0	20.00% 1	80.00% 4	0.00% 0	5	2.80

Figure 7.21: Post-trial Survey 2 (Response 8)

Q9 Do you feel that AMP properly addressed the IEP process, specifically goal management?

Answered: 8 Skipped: 0

#	Responses	Date
1	Yes. The behavior goals were right on the tablet ready to review.	4/28/2015 10:26 AM
2	It is a considerable option.	4/28/2015 7:56 AM
3	Yes	4/27/2015 7:52 PM
4	it was definitely helpful, but definitely has room for improvement.	4/27/2015 3:08 PM
5	Yes, but there is room for improvement on how to input IEP goal data. Need an easier to navigate list of students/ goals, and more options for entering different types of data. Having to do data entry that requires typing on a tablet. Having to go through the behavior screen to get to the IEP goal data entry page. Only having one type of input data for IEP goals (The slider with percentages) we should have options of different ways/formats to input performance data. e.g.- checkboxes, multiple choice, percentages, yes/no, etc. these will vary based on the language of the goal. There should be an option to select the type of data you wish to enter. Not just a slider bar.	4/27/2015 11:39 AM
6	No, I used it primarily as a way to track behaviors	4/23/2015 2:22 PM
7	No. I did not get progress on how the students were doing on their goals.	4/23/2015 2:07 PM
8	Yes	4/23/2015 1:12 PM

Figure 7.22: Post-trial Survey 2 (Response 9)

Q10 In the future, what features, if any, would you like to see added to AMP?

Answered: 8 Skipped: 0

#	Responses	Date
1	Multiple students on the same tablet.	4/28/2015 10:26 AM
2	"Met" or "Not Met" selection bubble instead of percentages, with the quarterly benchmarks laid out instead of the annual IEP goal, along with a comments section (which is there already).	4/28/2015 7:56 AM
3	None	4/27/2015 7:52 PM
4	opportunity to turn off real-time stamp and manual set it.	4/27/2015 3:08 PM
5	Different ways of inputting different types of IEP goal data. The user should have the option to select the way data is recorded for each goal: e.g.- checkboxes, multiple choice, yes/no, success/fail, percentage, etc.	4/27/2015 11:39 AM
6	way to implement IEP goals per student	4/23/2015 2:22 PM
7	Easier use with IEP goals.	4/23/2015 2:07 PM
8	None, just separate and enhance the IEP part	4/23/2015 1:12 PM

Figure 7.23: Post-trial Survey 2 (Response 10)

7.2.3 Discussion

The first few questions of trial two's pre-trial survey were identical to those of the last pre-trial survey, asking about the user's general experience and knowledge of technology. We received very similar responses as before. Remaining questions in the pre-trial survey asked specific questions to their IEP process, the focus of the user study. Question 7 asks about general interest in various features in an IEP system. Survey participants showed near equally high interest in real time access to data, reduction of paperwork, digitized data, printable reports, simple progress management, and collaboration among both parents and teachers. Question 8 asks survey participants to rate certain IEP tasks on a frustration scale. Users said that goal creation, collection of evidence, goal management, and reports were equally frustrating, each scoring above a 2.5 out of 5. Questions 9 and 10 ask about current technology used for IEP management, and which problems exist in those current technologies. Most participants mentioned the software that they currently used, and shared common desire for a paperless platform. They said that they had been manually entering paper data into a software system. AMP provides a great alternative, particularly because its mobile interface runs on tablets, allowing for data entry anywhere the caregiver might be.

Similar to the previous user trial, trial 2's post-trial survey was primarily to collect feedback about users' experiences with AMP over the past few months. This time, we also asked several questions about how well AMP addresses the IEP technology gap. The first question asks how often users use AMP. Results came in telling us that most users used AMP weekly, rather than daily. This was understandable, considering the fact that they were using the tablets primarily for IEP input, which tended to be a weekly task. Question 3 asks how well each subsystem improves the IEP process. Results yielded over a 3 out of 5. Seeing improvement was our goal.

Question 4 asks how well certain new IEP features helped the process. The most popular results were reduction of paperwork, digital data storage, and ease of managing multiple students' progress. Question 5 asks survey participants about particularly useful features of AMP. Popular responses were related to being able to easily input data on the fly, rather than in a folder at the end of the day. When asked about frustrations with AMP, responses typically surrounded the method of inputting textual data. Participants said that it took longer to type on the tablet than it did to write information on paper. In the future, bluetooth keyboards could be introduced to fix this issue. Questions 7 and 8 ask about user experience, the primary focus of trial 1; similar results were received. Question 9 asks the big question: whether users felt like AMP properly addressed IEP goal management. Most users responded yes, with the comment that it is just a start and a step in the right direction.

Chapter 8

Additional Experiments

The idea of AMP as a platform is best emphasized by the implementation of additional experiments and features. Up until this point, features added to AMP are primarily pertaining to the incorporation of visual schedules. Autistic children tend to have extremely high difficulty dealing with stress, and often times the majority of their stress comes from their constantly changing, jam-packed, busy schedules as discussed earlier in this thesis. Studies in the past have shown that this inherent stress is typically alleviated by visual support. Recent publications including Hayes' "Interactive visual supports for children with autism" [8] conclude that technology can play a very active role in incorporating visual support into the lives of these children.

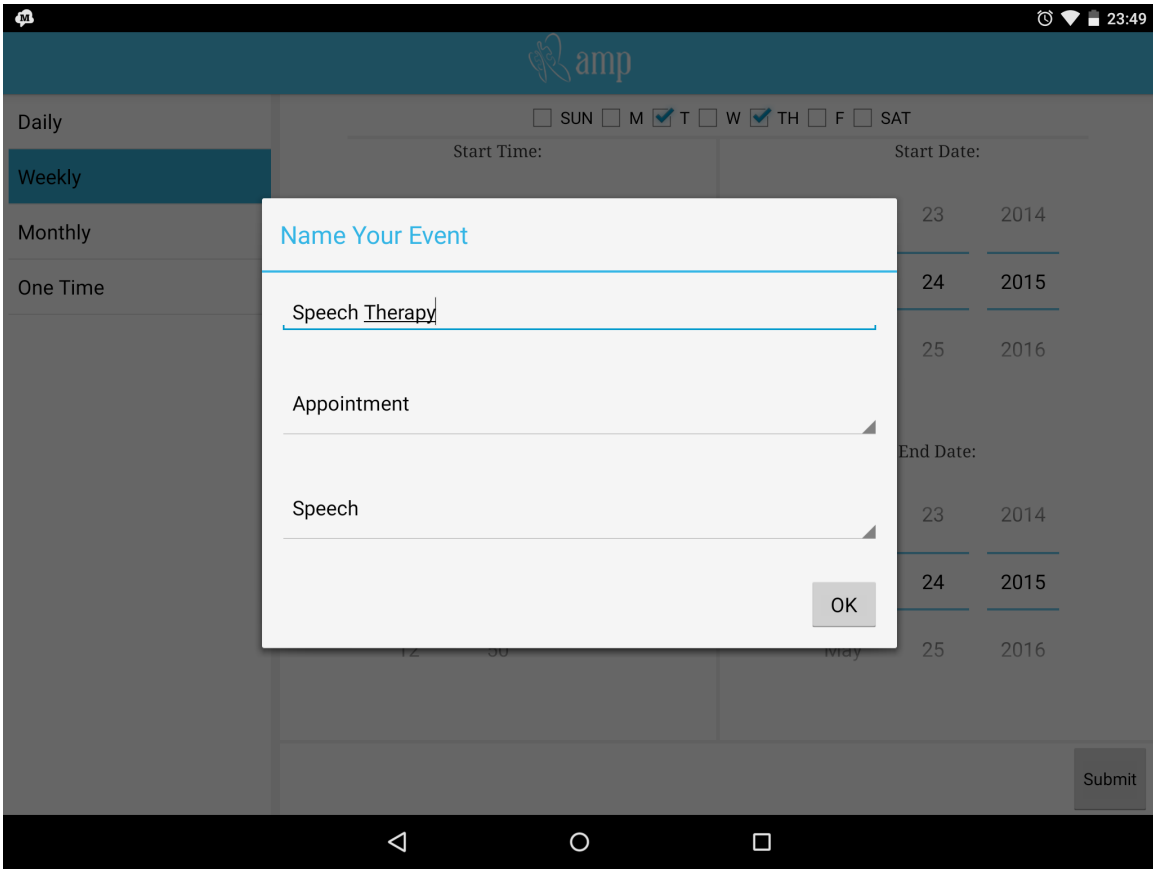


Figure 8.1: Categorizing an Event via AMP

AMP’s addition of visual schedules are much further discussed in a parallel thesis [13], but will be described briefly here. To further demonstrate AMP’s ability to act as a platform, we have added a few different subsystems in order to include visual queues into its current scheduling functionality. In order to apply a graphic to a schedule item, events needed to be categorized. The tablet application needed only to be modified slightly to incorporate this. As shown in figure 8.1, event creations were modified to include a category and a subcategory.

Categories and subcategories are used to show colors and graphics on separate mobile subsystems. Categories like school, sports, and appointments each yield a certain color that can be easily correlated with the respective category. Subcategories like bus ride, baseball practice, or speech therapy each yield a particular

related graphic. In order to show upcoming visual schedules to children with autism, we developed new applications to incorporate them.

The first application we added was a visual schedule android application. Depicted in figure 8.2, the schedule application shows a feed view of upcoming events with their associated color and graphic and notifies the user when their next event is approaching.

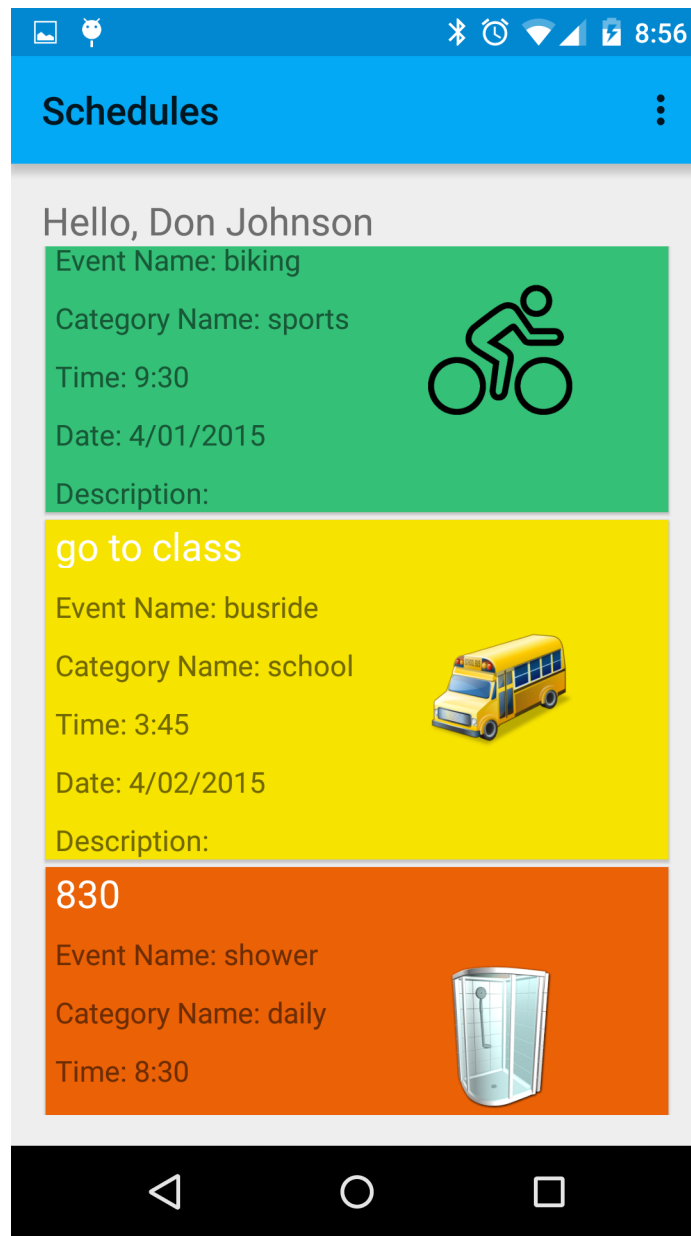


Figure 8.2: Visual Schedules on an Android Phone

Paired with the android application, we've also developed an android smart-watch wearable application and a Google Glass application. These apps simply display upcoming events on wearable interfaces with their corresponding color and graphic. With our Android Wear smart watch app, depicted in figure 8.3, a user is notified with a non-invasive vibration and a visual notification when an event is approaching. With the Google Glass application, depicted in figure 8.4, the user receives a vibrate, alert tone, and visual notification on their wearable headset.

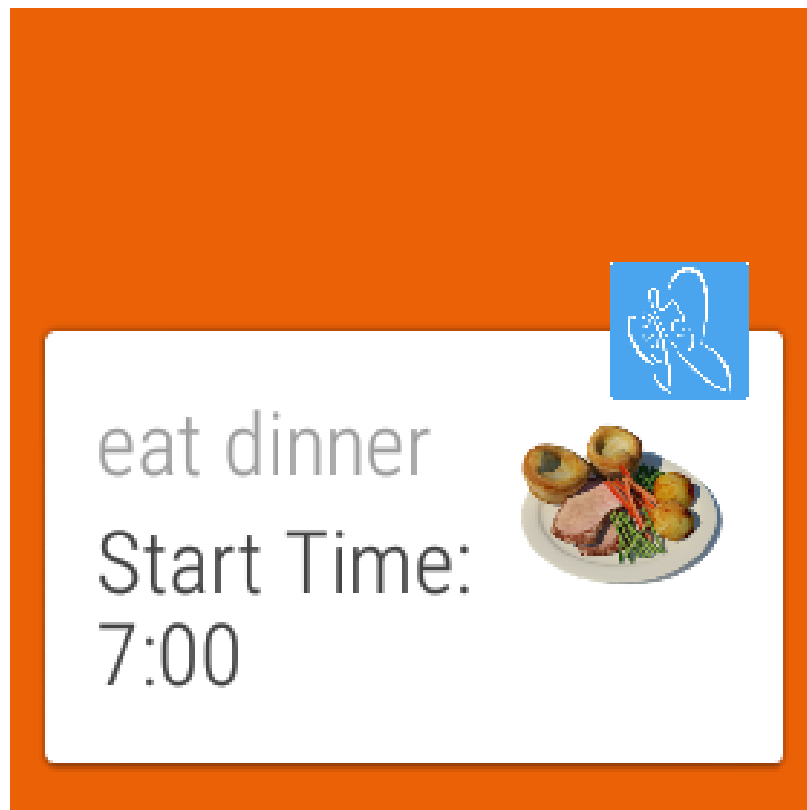


Figure 8.3: Visual Schedules on Android Wear

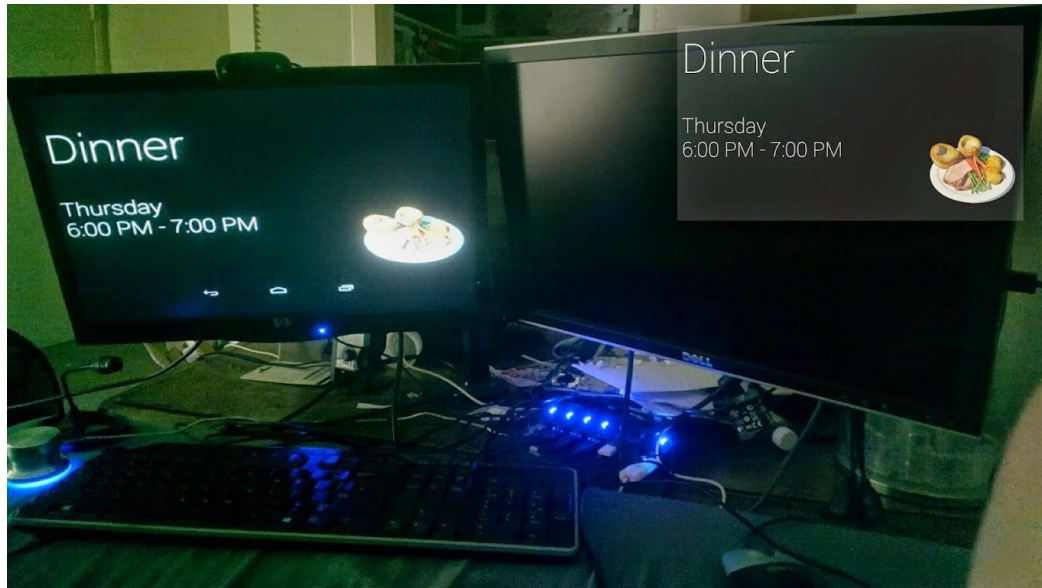


Figure 8.4: Visual Schedules on Google Glass

Lastly, the parent, physician, or teacher is also given access to a child's schedule through a web interface. Figure 8.5 shows AMP's web interface for visual schedules. With this addition, a caretaker can view, create and edit events for an associated child to see on their mobile phone, smart watch, or Google Glass device.

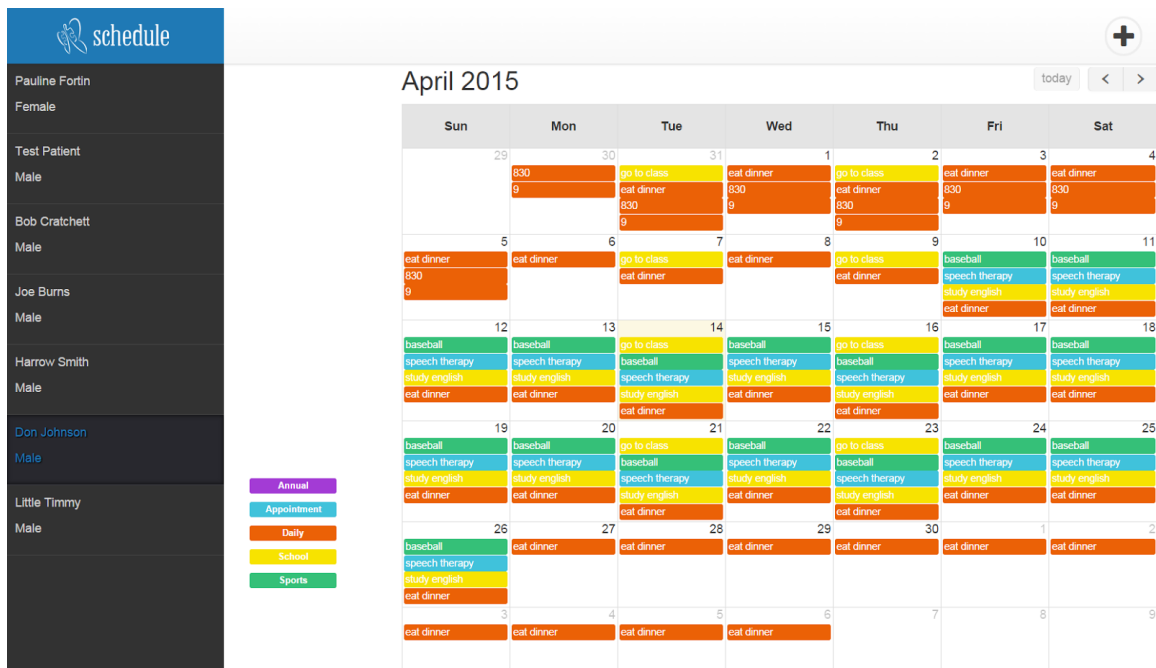


Figure 8.5: Visual Schedules on Web

Chapter 9

Conclusion

AMP's original main goal was to ease the lives of parents of children with autism. Through the system's development, we've discovered that it had the potential to do just that. By allowing parents, physicians, and teachers to record digital and media-rich data, it could ultimately eliminate paper records associated with child behavior. Posted submission could be viewed and sorted in chronological order to eliminate duplication of data and shuffling through folders and binders to find specific information. With AMP's mobile application, communication among caretakers could also be improved through the commenting framework, where users with authorized accounts could talk back and forth about a certain event or behavior in a child's life.

We also aimed to verify that AMP could in fact be used by real people in an effective and enjoyable way. Through two cycles of 3 month user trials at Edison High School's special education program, we gained much desired insight in this regard. Results showed that AMP was very user friendly, but could benefit with some improvements. This type of feedback drives future development, and AMP is only getting friendlier and easier to use.

Through the studies presented in this thesis, AMP has not only proven to be a useful asset to parents, but also serves as a platform for any new set of features and integrations. AMP has successfully been through a single user trial using new integrations, and welcomes a wide array of others, being as flexible as it is. Since the original development of AMP, the platform has allowed for several new features, again emphasizing it's flexibility and success as the platform that was originally intended.

In this thesis we have presented several problems with the current method of collecting special education data. Data collection, aggregation, and maintenance is far too convoluted, but that's not to say that there is no hope. Although AMP may not be the solution to the system being years behind in terms of technology, it's definitely a step in the right direction. The use of technology such as AMP to assist parents, professionals, and special needs children in the future is exciting and ever-progressing. With technology like AMP, streamlining data collection pertaining to autism and special education is finally possible.

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Appendices

Code Snippets

IEP Goal Database Model

```
public static class GoalEntry implements BaseColumns
{
    public static final String TABLE_NAME = "goals";
    public static final String COLUMN_CHILD_ID = "child_id";
    public static final String COLUMN_ID = "id";
    public static final String COLUMN_NAME = "name";
    public static final String COLUMN_DESCRIPTION = "description";
    public static final String COLUMN_DATE_COMPLETED = "date_completed";
    public static final String COLUMN_DATE_DUE = "date_due";
    public static final String CREATE_COMMAND = CREATE_TABLE + TABLE_NAME +
        " (" + COLUMN_CHILD_ID + INT_TYPE + COMMA_SEP + COLUMN_ID + INT_TYPE
        + COMMA_SEP + COLUMN_NAME + TEXT_TYPE + NOT_NULL + COMMA_SEP +
        COLUMN_DESCRIPTION + TEXT_TYPE + COMMA_SEP + COLUMN_DATE_DUE
        + TEXT_TYPE + COMMA_SEP + COLUMN_DATE_COMPLETED + TEXT_TYPE + ")"
        + SEMI_SEP;
    public static final String DELETE_COMMAND = DROP_TABLE + TABLE_NAME +
        SEMI_SEP;
    public static final String[] PROJECTION =
    { COLUMN_CHILD_ID, COLUMN_ID, COLUMN_NAME, COLUMN_DESCRIPTION,
        COLUMN_DATE_DUE, COLUMN_DATE_COMPLETED };
    public static ContentValues MakeContentValues(Goal g, int childId)
    {
        ContentValues values = new ContentValues();
        values.put(COLUMN_CHILD_ID, childId);
        values.put(COLUMN_ID, g.id);
        values.put(COLUMN_NAME, g.name);
        values.put(COLUMN_DESCRIPTION, g.description);
        if (g.dueDate != null)
            values.put(COLUMN_DATE_DUE, g.dueDate.toString());
        if (g.completeDate != null)
            values.put(COLUMN_DATE_COMPLETED, g.completeDate.toString());
        return values;
    }
}
```

```

public static Goal MakeModel(Cursor c)
{
    int id = c.getInt(c.getColumnIndexOrThrow(COLUMN_ID));
    String name = c.getString(c.getColumnIndexOrThrow(COLUMN_NAME));
    String description =
        c.getString(c.getColumnIndexOrThrow(COLUMN_DESCRIPTION));
    DateTime dueDate;
    try
    {
        dueDate =
            DateTime.parse(c.getString(c.getColumnIndexOrThrow(COLUMN_DATE_DUE)));
    }
    catch (Exception e)
    {
        dueDate = null;
    }
    DateTime completeDate;
    try
    {
        completeDate =
            DateTime.parse(c.getString(c.getColumnIndexOrThrow(COLUMN_DATE_COMPLETED)));
    }
    catch (Exception e)
    {
        completeDate = null;
    }
    return new Goal(id, name, description, dueDate, completeDate);
}
}

```

IEP Goal Database Retrieval

```

public static List<Goal> GetChildGoals(int childId, Context ctx)
{
    AMPDatabaseWrapper db = DB(false, ctx);
    List<Goal> goals = new ArrayList<Goal>();
    String selection = GoalEntry.COLUMN_CHILD_ID + " LIKE ?";
    String[] selectionArgs =
        { String.valueOf(childId) };
    Cursor c = db.query(GoalEntry.TABLE_NAME, GoalEntry.PROJECTION,
        selection, selectionArgs, null, null, null);
    while (c.moveToNext())
    {
        Goal goal = GoalEntry.MakeModel(c);
        goals.add(goal);
    }
}

```

```

    }
    c.close();
    db.close();
    return goals;
}

```

Presenting and Posting IEP Goals

```

public void showIEPs(View v)
{
    String[] displayGoals = new String[goalsList.size()];
    for (int i = 0; i < goalsList.size(); i++)
        displayGoals[i] = goalsList.get(i).name;
    final List<Goal> selectedItems = new ArrayList<Goal>();
    AlertDialog.Builder b = new AlertDialog.Builder(this);

    ScrollView goalListScrollView = (ScrollView)
        getLayoutInflater().inflate(R.layout.goal_list_layout, null);
    final LinearLayout goalListLinearLayout = (LinearLayout)
        goalListScrollView.getChildAt(0);
    new GoalListAdapter(this, goalsList).loadViews(goalListLinearLayout);
    b.setView(goalListScrollView);
    b.setTitle("Associated IEP Goals");
    b.setPositiveButton("Post", new DialogInterface.OnClickListener()
    {
        @Override
        public void onClick(DialogInterface dialog, int which)
        {
            List<PFBGGoal> selectedItems = new ArrayList<PFBGGoal>();
            for (int i = 0; i < goalListLinearLayout.getChildCount(); ++i)
            {
                LinearLayout itemView = (LinearLayout)
                    goalListLinearLayout.getChildAt(i);
                CheckBox selected = (CheckBox)
                    itemView.findViewById(R.id.cb_select);
                if (selected.isChecked())
                {
                    int goalId = Integer.parseInt(itemView.getTag().toString());
                    int percentage = ((SeekBar)
                        itemView.findViewById(R.id.sb_percentage)).getProgress();
                    IEPType goalType = IEPType.values()[((Spinner)
                        itemView.findViewById(R.id.s_type)).getSelectedItemPosition()];
                    PFBGGoal pfbGoal = new PFBGGoal();
                    pfbGoal.goalId = goalId;
                    pfbGoal.goalPercentage = percentage;
                }
            }
        }
    });
}

```

```

        pfbGoal.goalType = goalType;
        selectedItems.add(pfbGoal);
    }
}
try
{
    postFeedback(selectedItems);
}
catch (ServerException e)
{
    Toast.makeText(PostFeedbackActivity.this, "Sorry, there was an
        error: " + e.getMessage(), Toast.LENGTH_LONG).show();
    Log.i("PostFeedbackActivity", e.getMessage());
}
}
});
b.create().show();
}

```

Add Event Activity Creation

```

@Override
protected void onCreate(Bundle savedInstanceState)
{
    super.onCreate(savedInstanceState);
    requestWindowFeature(Window.FEATURE_CUSTOM_TITLE);
    setContentView(R.layout.activity_add_event);
    getWindow().setFeatureInt(Window.FEATURE_CUSTOM_TITLE,
        R.layout.custom_title);
    // init num arrays for time fields
    for (int i = 0; i < minutes.length; i++)
    {
        if (i < 13) hours[i] = (i < 9 ? "0" : "") + Integer.toString(i + 1);
        minutes[i] = (i < 10 ? "0" : "") + Integer.toString(i);
    }
    if (headersFragment == null)
        headersFragment = (EventTypesListFragment)
            getFragmentManager().findFragmentById(R.id.event_headers);
    if (dailyFragment == null) dailyFragment =
        DailyEventDetailsFragment.newInstance();
    Intent i = getIntent();
    int extra = i.hasExtra("AddOrEdit") ? i.getExtras().getInt("AddOrEdit")
        : 0;
    // child that this event is for
    childIdx = i.getExtras().getInt("childIdx");
}

```

```

childId = i.getExtras().getInt("childId");
// wheter add or edit event
edit = (extra != 0);
showDetails();
// edit list item click listener
ListView lvEvents = (ListView) findViewById(R.id.lv_events);
lvEvents.setAdapter(new ArrayAdapter<String>(this,
    android.R.layout.simple_list_item_activated_1, headerStrings));
lvEvents.setChoiceMode(ListView.CHOICE_MODE_SINGLE);
lvEvents.setOnItemClickListener(new AdapterView.OnItemClickListener()
{
    @Override
    public void onItemClick(AdapterView<?> parent, View v, int position,
        long id)
    {
        selectedItemPos = position;
        // event we're working with
        Event selected = events[position];
        // no matter what, populate start date and time, and end date
        EventType headerET = EventType.values()[selectedHeader];
        if (headerET == EventType.DAILY)
        {
            populateStartEndFields(selected, dailyFragment,
                R.id.dp_daily_start_date, R.id.tp_daily_start_time,
                R.id.dp_daily_end_date, R.id.tp_daily_end_time);
        }
        else if (headerET == EventType.WEEKLY)
        {
            populateStartEndFields(selected, weeklyFragment,
                R.id.dp_weekly_start_date, R.id.tp_weekly_start_time,
                R.id.dp_weekly_end_date, R.id.tp_weekly_end_time);
            // populate days of week
            boolean[] weeklyDays = selected.getDaysOfWeek();
            for (int i = 0; i < weeklyDays.length; i++)
                ((CheckBox)
                    llDaysOfWeek.getChildAt(i)).setChecked(weeklyDays[i]);
        }
        else if (headerET == EventType.MONTHLY)
        {
            populateStartEndFields(selected, monthlyFragment,
                R.id.dp_monthly_start_date, R.id.tp_monthly_start_time,
                R.id.dp_monthly_end_date, R.id.tp_monthly_end_time);
            // Day of month field
            EditText etDayOfMonth = (EditText)
                monthlyFragment.getActivity().findViewById(R.id.et_day_of_month);
            etDayOfMonth.setText(Integer.toString(selected.getDayOfMonth()));
        }
    }
}

```

```

        else populateStartEndFields(selected, onceFragment,
            R.id.dp_once_start_date, R.id.tp_once_start_time, 0,
            R.id.tp_once_end_time);
    }
});
// submit button listener
Button mButton = (Button) findViewById(R.id.add_event_submit);
mButton.setOnClickListener(new OnClickListener()
{
    @Override
    public void onClick(View v)
    {
        if (edit)
        {
            if (selectedItemPos == -1)
            {
                AlertDialog alert = new
                    AlertDialog.Builder(AddEventActivity.this).setTitle(R.string.error)
                        .setMessage(R.string.first_select_event)
                        .setPositiveButton("OK", new
                            DialogInterface.OnClickListener()
                            {
                                @Override
                                public void onClick(DialogInterface arg0, int arg1)
                                {
                                    // Do nothing
                                }
                            })
                    .show();
            }
            else
            {
                Event oldEvent = events[selectedItemPos];
                Event newEvent =
                    generateEvent(EventType.values()[selectedHeader], null);

                if (newEvent != null)
                {
                    Event eventToSubmit = updateEvent(oldEvent, newEvent);
                    Intent i = new
                        Intent("com.autismplatform.amp.PostFeedbackActivity");
                    i.putExtra("childIdx", childIdx);
                    // send event obj json
                    String eventJson = eventToSubmit.toAPIEventObj().toJson();
                    i.putExtra("eventObj", eventJson);
                    startActivity(i);
                    finish();
                }
            }
        }
    }
});

```



```

        else Toast.makeText(getApplicationContext(), "Your event is
            invalid", Toast.LENGTH_LONG).show();
    }
}
else
{
    final Dialog d = new Dialog(AddEventActivity.this);
    d.setContentView(R.layout.add_event_prompt);
    d.setTitle(R.string.name_event);
    catSpin = (Spinner) d.findViewById(R.id.sp_event_cat);
    catSpin.setAdapter(new
        ArrayAdapter<String>(AddEventActivity.this,
            android.R.layout.simple_list_item_1,
            getResources().getStringArray(R.array.event_categories));
    subcatSpin = (Spinner) d.findViewById(R.id.sp_event_subcat);
    catSpin.setOnItemClickListener(new
        AdapterView.OnItemClickListener()
    {

        public void onItemClick(AdapterView<?> parent, View view,
            int pos, long id)
        {
            String selectedCat = catSpin.getSelectedItem().toString();
            int arrayResId;

            if (selectedCat.equals("--None--"))
            {
                subcatSpin.setAdapter(new
                    ArrayAdapter<String>(AddEventActivity.this,
                        android.R.layout.simple_list_item_1, new String[]
                            {}));
                return;
            }
            if (selectedCat.equals("Annual")) arrayResId =
                R.array.annual_categories;
            else if (selectedCat.equals("Sports")) arrayResId =
                R.array.sports_categories;
            else if (selectedCat.equals("School")) arrayResId =
                R.array.school_categories;
            else if (selectedCat.equals("Daily")) arrayResId =
                R.array.daily_categories;
            else arrayResId = R.array.appointments_categories;

            subcatSpin.setAdapter(new
                ArrayAdapter<String>(AddEventActivity.this,
                    android.R.layout.simple_list_item_1,
                    getResources().getStringArray(arrayResId)));
        }
    }
}

```


Blank Surveys

Trial 1

AMP - Edison High School - User Feedback Pre-trial

***1. In the past year, how frequently do you use different types of technology?**

	Never	About once a Month	A few times a Month	About once a Week	A few times a Week	About once a Day	Everyday
Desktop Computer							
Laptop Computer							
Feature Phone							
Smart Phone (iPhone, Android, etc)							
eReader (Nook, Kindle, etc)							
Tablet (iPad, etc)							

***2. In the past year, how frequently do you use different features or services?**

	Never	About once a Month	A few times a Month	About once a Week	A few times a Week	About once a Day	Everyday
Email							
Instant Messaging							
Office Productivity (Word, Powerpoint, etc)							
Video call (Skype, etc)							
Facebook, Twitter, other Social Media							
LinkedIn, Monster, other Career Tools							

***3. Given the current available technology, how well do you feel it is being used to support education and child development?**

Not well Marginally well Well Extremely well

***4. Given the current available technology, how well do you feel it is being used to share data and communicate with educators and health care providers?**

Not well Marginally well Well Extremely well

Figure 1: Pre-trial Survey 1 (Page 1)

***5. Describe your frustrations with current technologies for working with health care providers and educators?**

***6. What features do you think would be most important in a tool to communicate with educators and health care professionals?**

***7. How interested would you be in a system to improve communication and data sharing between educators and health care providers in support of special education?**

Not interested

Somewhat interested

Interested

Very interested

Figure 2: Pre-trial Survey 1 (Page 2)

AMP - Edison High School - User Feedback Post-trial

***1. Given your experience with AMP, how well do you feel it improves data sharing and communication with educators and health care providers in the context of education?**

Not well Marginally well Well Extremely well

***2. What features of AMP did you find most useful?**

***3. Based on your experience with AMP, how convenient was the system to use?**

Not convenient Somewhat convenient Convenient Very convenient

***4. Compared to any previous technologies you have used, how useful was AMP in sharing data and communicating with educators and health care providers?**

***5. Do you feel that AMP properly addresses a current lack of technology for communicating and sharing data with educators and health care professionals?**

6. On a scale from 1 to 10 how likely are you to recommend AMP to ...

1 2 3 4 5 6 7 8 9 10

Parents

Educators

Health care providers

***7. Given your experience with AMP, did you find the user interface easy to use?**

Not easy Marginally easy Easy Extremely easy

Figure 3: Post-trial Survey 1 (Page 1)

***8. In the future, what features, if any, would you like to see added to AMP?**

Figure 4: Post-trial Survey 1 (Page 2)

Trial 2

AMP - Edison High School - SPO2015 Pre-trial

***1. In the past year, how frequently do you use different types of technology?**

	Never	About once a Month	A few times a Month	About once a Week	A few times a Week	About once a Day	Everyday
Desktop Computer							
Laptop Computer							
Feature Phone							
Smart Phone (iPhone, Android, etc)							
eReader (Nook, Kindle, etc)							
Tablet (iPad, etc)							

***2. In the past year, how frequently do you use different features or services?**

	Never	About once a Month	A few times a Month	About once a Week	A few times a Week	About once a Day	Everyday
Email							
Instant Messaging							
Office Productivity (Word, Powerpoint, etc)							
Video call (Skype, etc)							
Facebook, Twitter, other Social Media							
LinkedIn, Monster, other Career Tools							

***3. Given the current available technology, how well do you feel it is being used to support education and child development?**

Not well Marginally well Well Extremely well

***4. Given the current available technology, how well do you feel it is being used to share data and communicate with educators, health care providers, and family members?**

Not well Marginally well Well Extremely well

Figure 5: Pre-trial Survey 2 (Page 1)

***5. Describe your frustrations with current technologies for working with health care providers and educators?**

***6. What features do you think would be most important in a tool to communicate with educators and health care professionals?**

7. In an ideal IEP system, how important would the following features be to you?

	Not Important	Somewhat important	Important	Very important	N/A
Real-time access to data					
Reduction of paperwork					
Digital data					
Generate & print reports					
Easily manage multiple students' progress					
Possibility of parents & teachers using the same system					

8. How frustrating are the following aspects of the current IEP process?

	Not frustrating	Somewhat frustrating	Frustrating	Very Frustrating	N/A
Initial definition and creation					
Collection of evidence / notes					
Management of ongoing goals					
Reports and outcomes					

9. To what extent is technology currently used for IEP forms? Are there any challenges with the current IEP forms?

Figure 6: Pre-trial Survey 2 (Page 2)

10. If you could improve one aspect of the IEP system, what would it be, and how would you improve it?

Done

Figure 7: Pre-trial Survey 2 (Page 3)

AMP - Edison High School - SPO2015 In-progress

*** 1. How often do you use the AMP Tablet?**

- Daily
- Weekly
- Every 2 weeks
- Monthly
- Never

*** 2. How often do you use the AMP Website?**

- Daily
- Weekly
- Every 2 weeks
- Monthly
- Never

*** 3. Given your experience with AMP, how well did these components improve the IEP process?**

	Not well	Marginally well	Well	Extremely well	N/A
AMP Tablet					
AMP Website					
Combined usage of AMP Tablet & Website					

*** 4. In your opinion, how well did AMP with the new IEP features support these areas:**

	Not well	Marginally well	Well	Extremely well	N/A
Real-time access to data					
Reduction of paperwork					
Digital data					
Print data					
Easily manage multiple students' progress					
Multimedia attachments to IEP goals					
Better prompt data					

Figure 8: Post-trial Survey 2 (Page 1)

Data analytics

5. What features of AMP did you find most useful?

6. What did you find most frustrating about AMP?

***7. Given your experience with AMP, did you find the user interface easy to use?**

Not easy Marginally easy Easy Very easy N/A

AMP Tablet

AMP Website

***8. How friendly was the user interface?**

Not friendly Slightly friendly Friendly Very friendly

AMP Tablet

AMP Website

***9. Do you feel that AMP properly addressed the IEP process, specifically goal management?**

***10. In the future, what features, if any, would you like to see added to AMP?**

Done

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Figure 9: Post-trial Survey 2 (Page 2)