Identifying Helpful Feedback for Guardians of Children with Autism

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Abstract

Parents and guardians of children with autism spectrum disorder need good feedback on their children's learning progress when developing speech skills. However, there is a lack of specificity around the idea of what "good feedback" means to guardians. This is especially true when it comes to feedback through technological means for these guardians as technologies centered around this audience have rarely been studied. This study aims to find out what guardians of autistic children find important when learning about their children's speech development progress. Through the use of a survey sent to guardians of children with autism which utilized questions in the form of a modified love-breakup letter approach, five themes were deduced: specific, progress-related, knowledge sharing, proficiency-related, and direct. Along with this, the paper discusses the implications of these themes and how these may translate into technological feedback. An example dashboard is then proposed based on the constructed themes.

Identifying Helpful Feedback for Guardians of Children with Autism

Parents and guardians of children with autism spectrum disorder, or ASD, are generally stressed about their child's learning and want to be informed by teachers about their child's learning progress. Some of these guardians have a more difficult time interacting with their children because of the different lifestyle they must adapt to take care of their child and the unique interactions that this may entail (Lin et al., 2007). As a result, some parents and guardians in this category look for further support and guidance to cope with their extra stress. The use of technology in learning can assist both students and parents as a child grows; however, giving feedback to guardians of children with ASD can be tricky because not all teachers or therapists may be monitoring the child's learning progress online closely (or at least not in a concrete and measurable way). So, this paper aims to concretely define the ways in which parents of children with ASD would like to receive technological feedback to feel that they can effectively support their child's growth and development.

When it comes specifically to children with autism, adults must adapt and accommodate the needs of their autistic child more than other guardians with neurotypical children typically would (Corcoran et al., 2015). As such, the children require more attention from guardians when it comes to their individual learning needs. One particular area of growth in autistic children that requires more attention from a guardian to assist the child with is speech. Children with autism between ages two and five vary greatly in their speech skills. Further, these children exhibit significantly different neural and behavioral responses to different speech stimuli compared to neurotypical children of the same age group (Kuhl et al., 2005). As such, their growth may be more difficult to measure and may require more attention compared to their peers.

Technology is one way that young children can be monitored when further developing their speech skills. The use of technology in family child care and child care centers can be a beneficial method of learning for social, emotional, and physical development when used in moderation (Weinberger et al., 2008). Play-based digital games have also been found to help with a child's cognitive development and to reinforce healthy behaviors (Slutsky et al., 2014). This extends to children with disabilities who have improved their problem-solving skills and become more socially competent when using technological support for learning (Martin et al., 2004).

Yet, as learning in preschool and child care centers becomes increasingly entwined with technology, guardians of children with autism are concerned about being left behind with a lack of learning dashboards made specifically to keep them in the loop (Yaacob et al., 2021). These parents and guardians already have feelings of isolation because of a societal lack of understanding, causing them to be "living in a world of [their] own" as limited by an unsupportive developmental system - as such, these guardians have a desire to learn everything they can about how to properly support their children who have unique sets of needs (Woodgate et al., 2008).

What current research lacks, though, is what these guardians want to know so they can be armed with the knowledge they need to effectively raise their children. There is a lack of understanding as to the specific needs these guardians have when it comes to knowing about their child's speech learning progress when using technology. Therefore, the goal of this research study is to investigate two questions. First, what information do guardians of children with autism find important in regards to the child's speech development when learning in school

and/or therapy? And second, how can these values be translated into technological feedback for guardians?

To find the answers to these questions, the paper will first outline the current research in this field and the questions to be answered in relation to the research topic at hand. Then, this paper will dive into the methods which were used to define proposed answers to the proposed questions - a survey using the love-breakup letter methodology. This paper will then describe the qualitative analysis which was done to provide results to the study. Afterwards, the paper will end with a discussion of future implications within the fields of educational technology and learning analytics and the conclusions thereof.

Background

Uses for Technology made for Learning Speech

Within the field of medicine, many technologies centered around automatic speech-recognition, speech biomarkers, remote monitoring, and speech synthesis exist. These state-of-the-art ways to work with speech cannot only help diagnose psychological or speech-related disorders (including autism spectrum disorder) but can also assist in fixing speech and hearing impairments (Latif et al., 2021). For instance, services like Vocaliza that utilize automatic speech recognition (ASR) and pronunciation verification (PV) have been found to effectively assist young children with dysarthria or other neuromuscular disorders and language impairments in their pronunciation skills (Saz et al., 2009). Another service using ASR, Tell Me More, has been effective in helping students learn English as a foreign language by allowing them to individually practice and improve on their pronunciation (Elimat & AbuSeilkeek, 2014). Several other services exist to help a variety of people learn speaking skills, whether that's

children learning to pronounce words or college students getting feedback for delivering oral presentations (Ochoa, 2022).

But what services exist to help children with autism learn speech skills? It is difficult to have a unifying method to teach autistic children speech because of the wide array of ways that children with autism spectrum disorder (ASD) listen and learn. Still, researchers have found that educational interactive computer games have the potential to assist in speech development for autistic children because of the flexibility behind comfortable automated interactions that the child feels they have control over (Rahman et al., 2011). In fact, Leonard (2013) analyzed the effectiveness of an Augmentative and Alternative Communication vocabulary app called SonoFlex with three 10-year-old students who were diagnosed with ASD and had a moderate cognitive disability; the researcher found that the students who used the app improved in their abilities to make independent requests, respond to questions, and make appropriate social comments. So, these technological methods for helping autistic children learn speech have the potential to benefit many.

Guardian Feedback - Importance and Methods

Guardians play a significant factor in facilitating learning. They can fulfill several roles such as teacher, resource provider, or project collaborator based on the setting and materials around them (Barron et al., 2009). Ultimately, a parent's support can lead to the development of a child's autonomy through active support, structure, and involvement (Grolnick, 2009). Parents and guardians of children with autism take much care in working towards this goal to help their neurodivergent child survive in a foreign world. In the case of COVID-19, for instance, guardians of young children worked closely with teachers to assist the children in school with techno-procedural and material work while also surveilling their progress for the teachers (Gui et

al., 2021). Still, this is an example of parents assisting teachers in unexpected situations - but how do parents currently get the feedback they need to be a center for facilitating learning for their children?

One way parents receive feedback about their connection with their children is through a therapeutic setting, where parents communicate with providers about the ways in which they can interact with their children to support their learning needs. In therapy, when conducting psychological assessments of children, providers have been guided to give parents specific oral and written feedback such that they create a friendly and controlled environment (Tharinger et al., 2008). Most importantly, providers must watch for signs of discomfort to not overwhelm a parent when speaking with them specifically about their child's behaviors or the parent's own actions. From this, if a parent receives new and discomforting information about their child, for instance, then it may be difficult for a therapist to navigate a conversation with a parent undergoing cognitive dissonance. Besides a direct conversation based on the observations of a therapist alone, another form of feedback from therapy is through video interventions. The Video-feedback Intervention to promote Positive Parenting and Sensitive Discipline is an example of this where parents reflect on their child's behaviors in videos and voice those behaviors to reflect and observe patterns as a way to develop sensitive parenting techniques (Juffer et al., 2017). Through this method, parents can learn to effectively discipline not only their children but also their own ways of acting and speaking around their children. Video feedback has also been used effectively in a therapeutic setting with parents of children who are prelingual deaf or hard-of-hearing (Lam-Cassettari et al., 2015). In this process, parents watched their own interactions with their children and reflected in such a way that they became less frustrated and more sensitive to their children's unique needs. As such, this method of feedback

can be a way to intervene with a child-parent relationship early-on so that the child is raised in a healthy manner. Still, video feedback is not a be-all-end-all either - in a therapeutic setting, the real goal should be to utilize a mix of different forms of feedback to fully engage a parent in their child's development process.

Young children do not only learn in therapy with providers, but in school with teachers as well. Over the height of the COVID-19 pandemic, parents generally expected teachers to send frequent messages, upload content, and update due dates accurately and at a reasonable time so the parent could monitor their child's progress in the home environment (Bhamani et al., 2020). Parents like when these communications from teachers happen regularly with parents preferring a variety of ways to exchange information with a teacher such as through email, texting, or even social media (Thompson et al., 2015; Hu et al., 2009). If a guardian cannot communicate directly with a teacher, though, they may instead be provided with a learning platform for parents to check-in on their child's progress in a course. Learning platforms can also be used to share newsletters or information about activities happening in the school to keep them informed about the larger school environment their child is a part of (Selwyn et al., 2011). In this sense, parents are provided with a variety of ways to get feedback on their child's learning progress so that they may help their child grow.

Different methods of communication work well for different types of parents, but the consensus is that parents enjoy having feedback about their child's learning progress as a way to help them facilitate learning in the home environment. However, what's missing from research is the exact details of what parents of children with ASD want from the feedback they are provided. At times, parents may feel uninformed about the issues that matter most to them; at other times, providers may flood parents with information or communicate with guardians excessively (Yu et

al., 2021). Both kinds of information exchange can be stressful when providers miss the mark on what truly matters to the guardians themselves. Subsequently, more information is required on specific parent needs for feedback so the feedback itself can be helpful rather than excessive or uninformative.

Learning Dashboards

According to Sedrakyan et al. (2018, p. 12), dashboard feedback can be helpful with learning if it "takes into consideration the regulatory mechanisms underlying learning processes" such as planning, monitoring, and adapting. By taking a human-centered approach, dashboards can identify and analyze effectiveness and efficiency in a user's learning. Because of the awareness of what a student's progress is, the user or facilitator can then contemplate what they may need to emphasize more in their learning and what they are performing well at. Abelardo Pardo (2014) outlines five stages of designing a learning analytics experience to demonstrate the possible effectiveness of learning dashboards; these stages are capture, report, predict, act, and refine. Stakeholders generally see the "report" and "predict" stages in action most often as these are the stages which display feedback and the implications of such statistics – this is done so stakeholders (or the technology that the dashboard is part of itself) can then act on the analyzed data to improve the learning process of a user (typically a student). When following these steps in the case of guardians of children with ASD, stakeholders (the guardians) can then benefit from the learning analytics experience to provide supplemental learning opportunities for their child.

Dashboards can help with a number of tasks and are moreover made for different purposes. For instance, some dashboards made for students help them reflect on their learning progress either by providing automated feedback for assignments like essays or by "surveying" students to make them more aware of their learning habits (Ferguson et al., 2016). These services

are more student-oriented and can be utilized in the case of individual students learning on their own. On the other hand, learning dashboards within the field of Computer-supported Collaborative Learning are more geared towards assisting those who administer assignments for learning (van Leeuwen et al., 2019). In fact, Klerkx et al. (2017) found that most learning dashboards are made for these two types of audiences: students and teachers/administrators (along with developers of the dashboards). Klerkx et al. sum up the purposes these learning dashboards have for these audiences when they claim that the dashboards are made for:

1. Learners to gain insight into their learning actions and the effects these have
2. Teachers to stay aware of the subtle interactions in their courses
3. Researchers to discover patterns in large data sets of user traces and to communicate these data to their peers

This has been found true in many different learning settings for different age groups with dashboards aiming to engage students with material and inform teachers about the class (Kovanovic et al., 2021; Reimers & Neovesky, 2015).

Luckily, though, some dashboards are also built for a parental audience. Some will notify parents about new or significant grade updates, which can help parents or guardians to enforce learning outside of a school setting (Reimers & Neovesky, 2015). Still, there are less dashboards available for the parental audience than those of teachers or the students themselves. The dashboards that do exist for guardians are less likely to consider what guardians specifically want to know about their child's learning; instead, the dashboards will provide guardians with different ranges of information from minimal to overwhelming (Selwyn et al., 2011). These learning dashboards do not follow standards of how learning analytics should be presented and utilized such as standards identified by scholars Jivet, Specht, Scheffel, and Drachsler (2018, p.

38) who agree that developers should “not assume the dashboard will have the same effect on all its users, but rather seek to determine which group of learners benefit the most and how to customize the dashboard to provide the same support to all its users”. Additionally, parent-centered dashboards are lacking more for autistic children learning speech, as guardians are usually filled in on learning updates from providers or simply let their children use the technology if they believe it is beneficial to the child. This is why the paper will focus on finding the needs of parents of autistic children learning speech - so that these needs may be properly demonstrated through a service such as a learning dashboard to aid both the parent and the student in the student’s learning process.

Summary

As shown above, the current gap in this field of research is that parents and guardians of children with ASD are not being polled about what feedback they would want when it comes to their children’s development of speech through technological means. So, how will this study fulfill this gap? This research study will investigate two questions. First, what information do guardians of children with autism find important for their child’s speech development when learning in school and/or therapy? And second, how can these values be translated into technological feedback (in the form of a dashboard) for guardians whose children learn through digital means? From these two prompts, a learning dashboard will be created based on data from a survey of guardians who have autistic children learning speech in school or therapy; this dashboard aims to accurately represent feedback guardians desire about their child’s learning.

Methods

Participants and Sampling Methods

Participants were recruited via convenience sampling methods. A solicited message was sent out on platforms which was targeted at parents and guardians of children with autism.

Specifically, participants in this study were parents or guardians of children with autism between ages 2 and 7 who were currently in therapy or school for their early speech development. These guardians had to have at least one child fitting the above criteria to participate in the study. The purpose of studying these specific individuals was to gain real insights as to the daily lives of guardians today. Snowballing methods were used to further recruit more participants. Ultimately, the research team was able to recruit one participant for the study. This respondent was not only a parent of a child with autism learning speech, but also an elementary school special education teacher. So, they were able to provide insight as both a parent and a provider of education. Their child is in school learning speaking skills rather than taking part in therapy outside of school.

Design and Materials

A survey captured the lived experience of the guardians mentioned above. The reasons for this were to get individual responses without outside influence from peers and to keep participants anonymous. When working alone, individuals tend to generate more unique ideas than if they were working in groups (Mullen et al., 1991). So, a survey was fitting to emphasize this originality and keep responses genuine to the lived experience of the guardian.

Participants were given 20 minutes to complete the one-time survey. The survey started with one question to confirm that the participant taking the survey was in the demographic being studied. Afterwards, a prompt followed to get participants primed to think of a situation in their day-to-day life in which they last checked in on their child's learning progress when developing speaking skills. Then, two questions were given to the participant in a random order; these questions modeled the Love-Breakup Methodology to developing designs in fields like UX and Medical Education (Su et al., 2017; Laughley et al., 2020; Holstein et al., 2019). Typically, this effective method dissects the thoughts and attitudes of participants by asking them to write a love

letter and a breakup letter to an abstract idea, service, or technology that they are familiar with. However, these questions were slightly altered because of ethical concerns regarding the potential romanticization between a guardian and the provider who has worked with their child; rather than asking for a love letter and a breakup letter, the survey asked for stories where participants described what they really liked and disliked about the ways a provider shared information with them about their child's learning progress. Here are the prompts for these two questions:

> "Write a letter where you describe some things that you **really liked** about the ways that provider shared information. Feel free to write anything that comes to mind. If you could write for about 7-10 minutes, that would be great. Do not include any personal identifying information in your response."
>
> "Write a letter where you describe some things that you **really disliked** about the ways that provider shared information. Feel free to write anything that comes to mind. If you could write for about 7-10 minutes, that would be great. Do not include any personal identifying information in your response."

Data Collection and Analysis

Data was anonymously collected and analyzed through the survey. The open-ended responses participants provided were then analyzed through an inductive thematic analysis. This method of qualitative analysis involves coding semantic content and identifying themes from the codes - generally, this involves working through a dataset systematically to identify interesting parts to each response and map the responses together to identify themes (Braun & Clarke, 2006). However, because there was only one participant response to work with, themes were drawn more directly from the semantics of the response to decode themes and then define them.

The collected themes were then interpreted to make a prototype for a learning dashboard which represents the needs of the guardian as described in their response.

Ethical Considerations

The issues of anonymity, feelings of sadness & anxiety, confidentiality, recruitment, and written consent were considered throughout the duration of the study. The University of San Diego Institutional Review Board reviewed this study and approved of the ethics behind it.

Results

The single participant's survey answers were analyzed for themes that centered around likes and dislikes about how they receive information on their child's learning progress. Ultimately, five overlapping themes were gathered from their response: specific, progress-related, knowledge sharing, proficiency-related, and direct.

Themes

Specific. The participant emphasized a need for clarity and specificity around their child's learning. They identified with the struggle teachers have in giving student-specific feedback, but would rather have student-specific feedback compared to weekly emails or occasional Facebook posts:

> "We receive weekly emails with information about what the class is doing as a whole as well as occasional posts in a Facebook group and those are nice, but are obviously about the class as a whole versus getting specific feedback. I don't think that we get as much feedback on her individual progress specific to her that I would like"

Because of this, if the option existed, they would prefer to have child-specific feedback that is clear and concise even if their student is on target with the provider's goals for their learning.

Progress-related. The participant likes to hear about their child's learning in the form of progress over time. If this were to be made specific to the child's learning rather than the class as a whole, the parent feels that they would be better informed on whether or not their child is struggling or thriving in the classroom. They also feel that this would further make clear the needs of the child so they can help their child in areas they may be struggling in:

> "I appreciate when providers are able to give me information that is clear and direct in what they see with my child's needs and the progress they are making."

Knowledge sharing. To further complement their child's learning, the participant wanted details on the ways in which their child is currently learning in school. This parent wants the information they receive to be detailed enough such that they can mimic the environment and methods created in the classroom to provide supplementary material at home:

> "I would like to be able to have more knowledge of the routines and procedures for the classroom… so that I could provide consistent routines, procedures, and strategies with my child at home."

Proficiency-related. This parent wants to have knowledge of the current priorities for their child's learning. Namely, the parent would want to know if their child is struggling or expressing problematic behaviors when it comes to certain tasks or topics. They currently appreciate that this information would likely be given if their child was expressing such problematic behaviors, but because the parent wants child-specific feedback they would prefer this information to be proactive rather than reactive. By knowing what the student should be prioritizing with their learning, the parent then has the opportunity to provide extra guidance for their child:

> "I don't think that we get as much feedback on her individual progress specific to her that I would like but I understand that because she does not have problem behaviors similar to other students that usually there is less need for communication."

Direct. Finally, the participant appreciates feedback that emphasizes the positives. However, they dislike feedback that is overly positive:

> "If there are concerns, I think it is important to be upfront about the concerns instead of receiving feedback in an overly positive way."

Therefore, instead of sugar-coating a child's needs and progress, this parent wants a clear picture of their child's learning which includes both the positives and negatives so they can raise their child in a way that complements their formal learning in school.

Interactive Learning Dashboard

The five themes found above create an image of a parent who wants specific, progress-related, knowledge sharing, proficiency-related, and direct feedback about their child's learning progress in school. But what does this mean in terms of technological feedback? Researchers must be careful not to present parents with an overwhelming amount of information while still keeping it informative and related to guardian needs.

Addressing guardian concerns above is the most important part of the process in analyzing what feedback is needed and relevant. First, the problem of specificity can be solved by making technological feedback individual to a student. So, when creating a dashboard in this manner, the dashboard should thus provide observations that show the details of how an individual student has been performing with their work. This is a common practice for most technological dashboards that are user-specific. Second, in terms of progress, learning dashboards designed for guardians should thus show growth over time. This is more of a priority

than simply showing current progress, which does not mention anything about the history of the user. It is the user's history which informs guardians on whether or not their child is progressing or stagnating in their progress. Third, identifying specific problems or questions a student has completed is a good way to share knowledge with parents and guardians on the work their child is being given to complete. By viewing their child's performance when given specific prompts, guardians can deduce strategies to assist their children in learning while not using technology. Fourth, proficiency details can be emphasized by showing guardians the amount of work their child is completing within different subjects. This leads to insights on what the technology is giving the student to practice based on the natural progression of their learning or the subjects that the technology deems most important for the student to practice (depending on the technological product and how it determines lesson plans). Along with this, showing the performance within each subject can create a sense of where a student is struggling or exceeding expectations. This leads into the last theme, being direct; by showing how a student is performing within each subject, parents and guardians can also be more informed on both the positives and negatives around their child's current progress with completing tasks.

From the above conclusions, a dashboard was created with the hopes of accurately representing guardian needs. For this dashboard, a sample dataset was created with questions generated as if a student was working on their listener responding skills; these skills can be effective in the development of speech, meaning this data would be a realistic representation of how data may be organized for a learning dashboard if an autistic child were to learn through technology (Lorah & Karnes, 2016). Figure 1 shows a full view of the prototype dashboard landing page if the app were to be used on a device such as a tablet. An option to select dates of a child's learning in the top right makes this dashboard progress-related because the dashboard

presents child-specific data feedback in terms of average correctness according to the question prompts on that day.

Along with this, colors are used in the dashboard to fulfill the “direct” category of feedback that a guardian or parent would want by emphasizing both the good and the bad of how their child is performing. The color green represents positive growth while the color red represents areas for improvement; these colors were chosen based off of past research that bright colors elicit more responses from adults, with the color green generally being seen as representative of growth while the color red is generally seen as representative of danger (Adams & Osgood, 1973; Hemphill, 1996). This gives guardians unbiased insights on the current priorities of their child’s learning.

To make the data more specific in terms of knowledge sharing, a heatmap shows the different word topics a child was working on learning with the label being the type of question they were given. The size of the box for a prompt represents how many questions a student has answered for that type of prompt (to show a more “physical” representation of where the weight of a student’s learning is happening). This heatmap will also be sorted based on the range of dates which the parent has selected in the top right corner of the screen (Figure 3). This allows a parent to dive deeper into their child’s learning to gather further information on their child’s learning over time. Along with this, parents can view the details of boxes in the heatmap to get more specific, quantifiable information (Figure 2).

As a way to achieve a relation to the theme of proficiency, guardians can also click on a specific word target in the heatmap and will then be led to another page which shows details in regard to that child’s learning of that word over time (Figure 4). By being able to investigate a child’s progress on a specific word over time, a guardian can then get a better understanding of

the current priorities for a student by looking at the trends that show whether a student may be improving, regressing, or staying stagnant in their progress. This would allow a guardian to know what subjects they should be assisting their child with learning in juxtaposition to the ones where a child needs less help.

Discussion

This work set out to include parents of children with autism in the conversation of receiving meaningful feedback on their young child's speech learning progress. As a result, the five themes discussed in this paper can be applied to the existing literature to fill the identified gap. These results, for instance, will allow parents to connect with their child through technology and then bring this feedback back to the teachers and therapists who are assisting their child with the child's growth. From this, parents can then become more embraced and included within the learning environment because their specific needs are being addressed. Rather than having providers send out too much or too little information to parents of children with ASD, the thematic approach from the parental point of view puts these stakeholders first and erases the need for providers to guess what guardians need. The dashboard proposed here not only has the potential to help parents, but technological researchers as well; using the dashboard as a model could have the potential to prove beneficial when considering the parental point of view (and not just those of the learner, teacher, or researcher).

Limitations and Future Directions

However, this study had several limitations. As a survey, this study was meant to analyze the opinions of several parents of children with autism between ages 2 and 7 learning speech. However, the largest limitation behind this study was that only one response came back with analyzable data. As such, the results found here will not be generalizable to the larger population

and more research needs to be conducted in this area. This is a difficult population to reach because guardians of young children with autism are generally preoccupied with their busy lives managing their families.

Another option would be to open up the survey to all guardians of children with autism so the research pool is not as limited. Even though this direction may mean that not all of the parents currently have children with autism still in school (meaning some of the parents would have to recollect their past rather than draw on their current day-to-day experiences), having a larger amount of data to analyze is the priority to dig deeper into the topic of interest. Doing so will cause the results found here to be more generalizable for the audience of guardians of children with autism. As such, a wider range of experiences can be coded and analyzed to draw more comprehensive themes. By taking a bottom-up approach through semantic thematic analysis, the themes will then be better representative of the guardians of children with ASD. The five themes deduced above should be cross-referenced with more opinions and, as a result, then the above dashboard proposal can also continue to be revised until it more accurately represents the larger population at-hand.

Ultimately, this study found that several themes may be important to guardians of children with autism when trying to find out information about their child's learning progress. Through doing so, a dashboard was then created to represent these themes through the form of technological feedback for guardians. From these themes and the dashboard established, a larger discussion can happen about the best practices for taking a parent-centered approach towards providing feedback within the specific population at hand.

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Figure 1

Prototype dashboard for guardians of children with autism between ages 2 and 7 - landing page

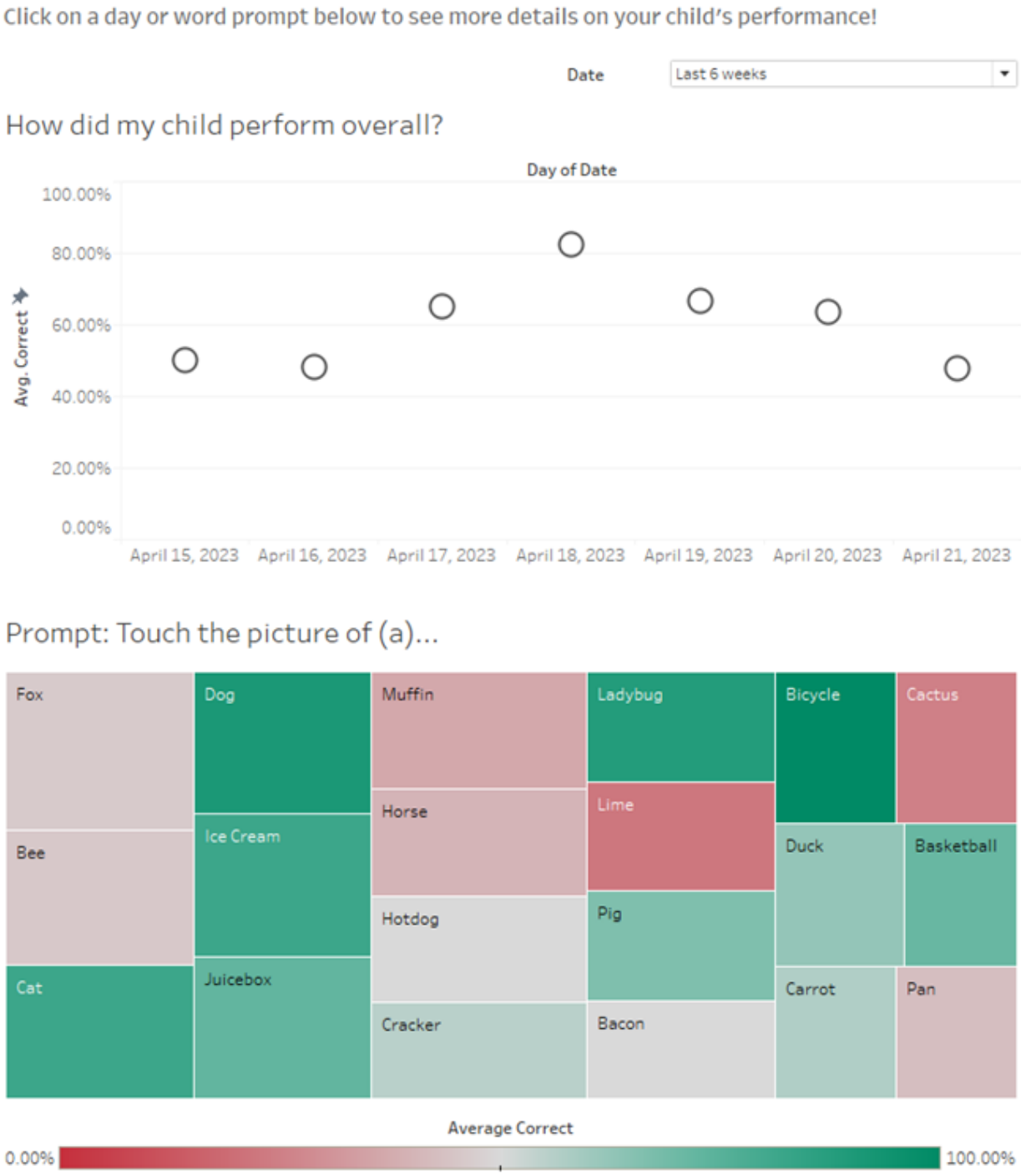

Figure 2

Heatmap details for guardian prototype learning dashboard with a child's learning on the "lime" target for the specified date range

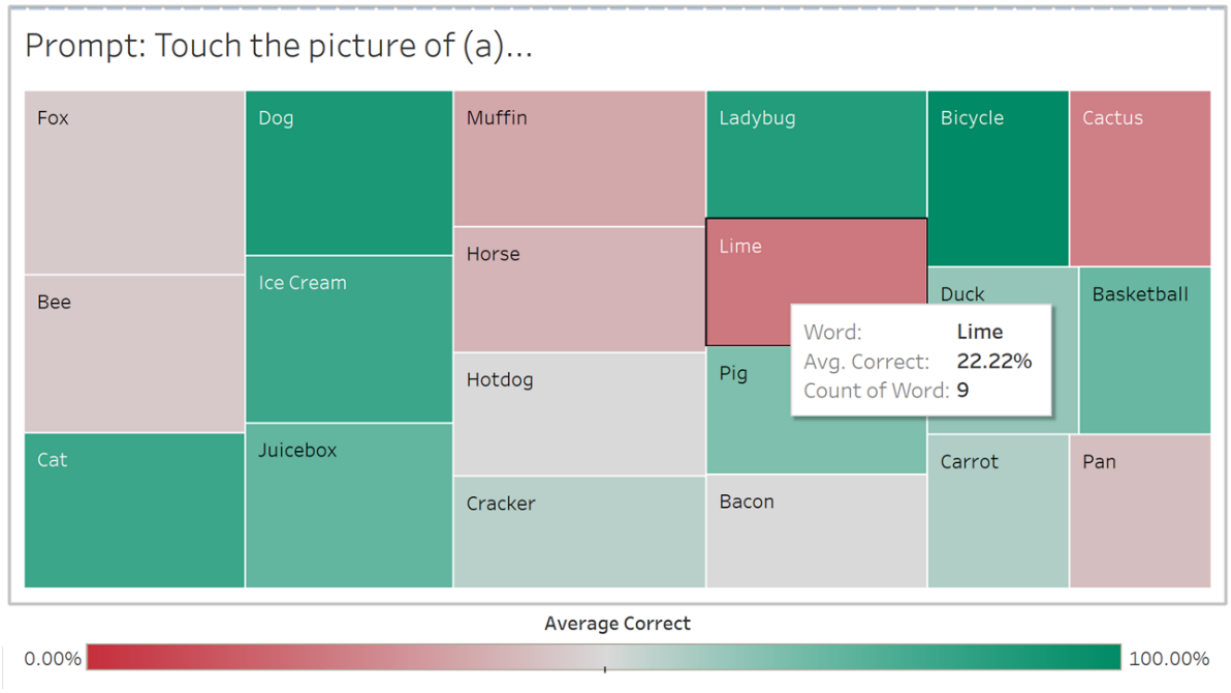

Figure 3

Prototype dashboard page sorted by a child's learning on Sunday, April 16

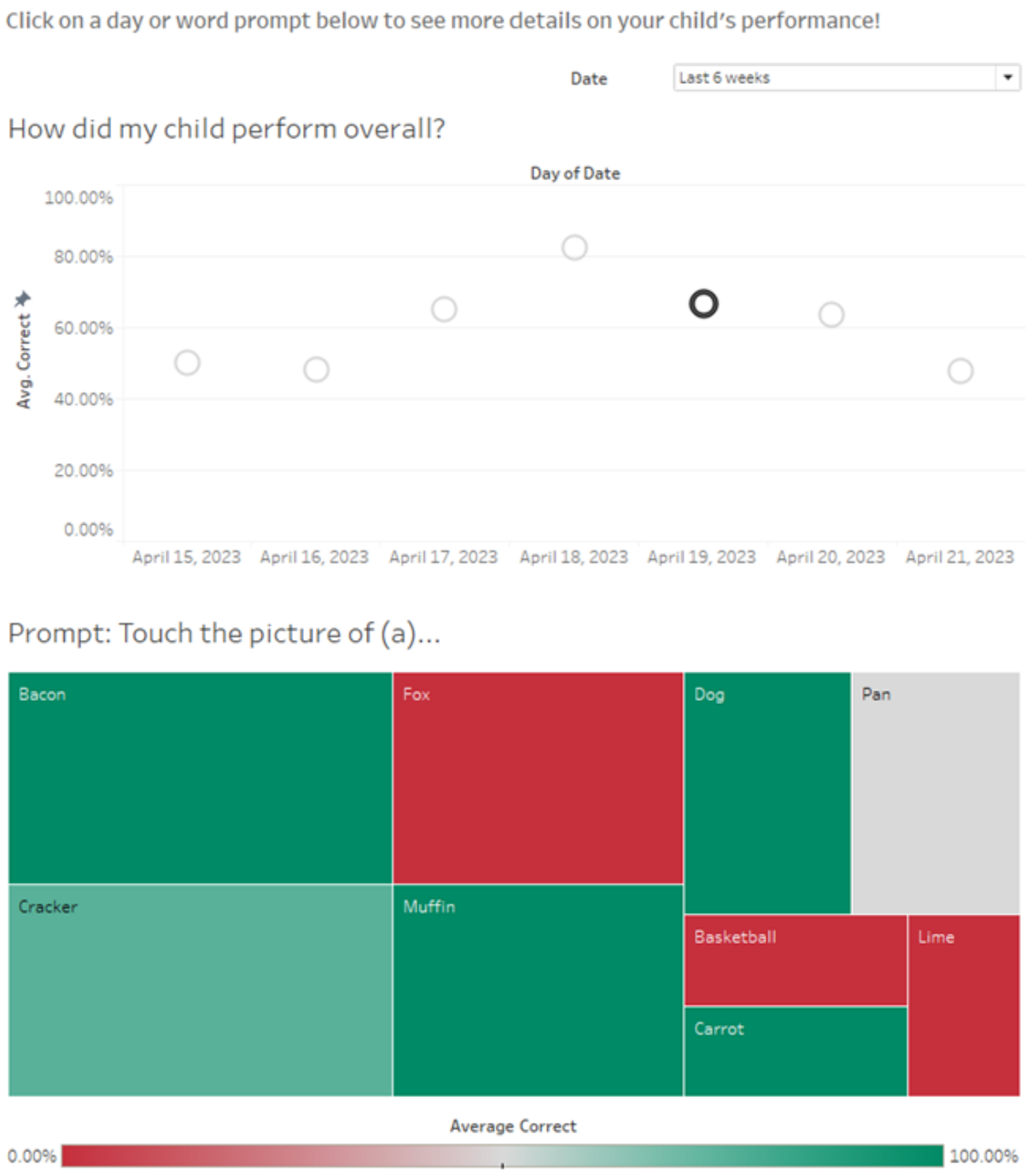

Figure 4

Dashboard prototype page showing a child's progress when learning to recognize carrots; this child is improving in their ability to recognize carrots