

Spring 2018

Augmented reality for at-home speech intervention

Emily Vayo
James Madison University

Follow this and additional works at: <https://commons.lib.jmu.edu/honors201019>



Part of the [Speech Pathology and Audiology Commons](#)

Recommended Citation

Vayo, Emily, "Augmented reality for at-home speech intervention" (2018). *Senior Honors Projects, 2010-current*. 615.
<https://commons.lib.jmu.edu/honors201019/615>

This Thesis is brought to you for free and open access by the Honors College at JMU Scholarly Commons. It has been accepted for inclusion in Senior Honors Projects, 2010-current by an authorized administrator of JMU Scholarly Commons. For more information, please contact dc_admin@jmu.edu.

Augmented Reality for At-Home Speech Intervention

An Honors College Project Presented to
the Faculty of the Undergraduate
College of Health and Behavioral Sciences
James Madison University

by Emily Marie Vayo

Accepted by the faculty of the Department of Communication Sciences and Disorders, James Madison University, in partial fulfillment of the requirements for the Honors College.

FACULTY COMMITTEE:

Project Advisor: Susan B. Ingram, Ph.D.,
Assistant Professor, Department of Communication
Sciences and Disorders

Reader: Richard E. Ingram, Ph.D.,
Assistant Professor, Department of Learning,
Technology & Leadership Education

Reader: Marsha Longerbeam, Ph.D.,
Assistant Professor, Department of Communication
Sciences and Disorders

HONORS COLLEGE APPROVAL:

Bradley R. Newcomer, Ph.D.,
Dean, Honors College

PUBLIC PRESENTATION

This work is accepted for presentation, in part or in
full, at the Speech-Language-Hearing Association of
Virginia on March 23, 2018.

Augmented Reality for At-Home Speech Intervention

Emily Vayo

James Madison University

Abstract

Augmented Reality (AR) is a technology that allows users to view graphics, videos, or other applications in their environment in real time using mobile devices, such as a smartphone or tablet. It provides an interactive way to combine technology and learning. Although AR has potential applications in the field of Communication Sciences and Disorders, few studies have investigated its reliability in speech intervention. This project explores whether parents are receptive to implementing AR technology into speech intervention and addresses one way to make intervention more engaging. The project looked at parental attitudes toward AR in integrating speech intervention goals at home with their children. A case study approach was used to evaluate the receptiveness of parents using AR in intervention. Caregivers were given a pre- and post-study survey and were asked to complete weekly reflective notes to track progress. The researcher met with caregivers two times over the course of the study (one at the halfway mark and the other at the end of the study) in an interview to answer any questions and address comments or concerns. Results will provide researchers and clinicians with an idea of how receptive parents are to incorporating a new technology into intervention and help determine if the use of AR in intervention at home merits further exploration.

Augmented Reality for At-Home Speech Intervention

Parental involvement in at-home speech and language intervention is important for reinforcing the strategies that a child learns in child-based therapy with a clinician. Parents are encouraged to be involved in the clinical process. Speech intervention routinely employs a family-centered approach. This means that parents and professionals work together to meet the goals of intervention (Bowen & Cupples, 2004; Watts Pappas, McAllister, & McLeod, 2016; Watts Pappas, McLeod, McAllister, & McKinnon, 2008). Working with parents allows professionals to understand parents' feelings and concerns regarding intervention. It also allows families and clinicians to generate a plan that is well-suited to the child. Parental involvement has been shown to increase the efficiency and effectiveness of treatment (Bowen & Cupples, 2004; Sugden, Baker, Munro, and Williams, 2016).

Much of the literature surrounding parental involvement in therapy examines attitudes of speech-language pathologists (SLP) and parents towards intervention at home and the effectiveness of intervention. Watts Pappas et al. (2016) found that parental attitudes toward being involved in intervention depends on the quality of the SLP, how the child responds to intervention, and the length of time intervention was anticipated to last. Studies have also found that it is important for parents to be comfortable with the tools they are using in homework activities with their children (Bowen & Cupples, 2004).

New technologies may make integrating intervention more efficient. Augmented Reality (AR) is defined as “a technology that allows computer-generated virtual imagery information to be overlaid onto a live direct or indirect real-world environment in real time” (Lee, 2012, p.13). This technology can be used with a mobile device, like a smartphone, making it easily accessible to people with these devices. AR is a tool that allows parents and their children to work on

integrating intervention goals at home in an engaging and interactive way. However, there is currently limited research integrating AR technology into speech intervention. This study will contribute to professionals' knowledge in the field by exploring an alternative way to encourage parental involvement in addressing the clinical process.

This honors project explored how receptive caregivers were to incorporating AR into integrating intervention strategies at home. This research may be beneficial to other researchers and clinicians in the field by highlighting the potential uses of AR in at-home therapy. It could also benefit parents and families of children who require speech services by introducing new practices into integrating intervention at home. This project may empower parents by giving them a new way to interact with their children while engaging in goal-based activities at home.

Background

The origins of AR trace back to the 1960s, but public use and increasing affordability is a rather recent development (Lee, 2012; Pelargos et al., 2017). Studies have shown AR allows for increased engagement in activities (Foronda et al., 2016; Joan, 2015) and gives users an enjoyable way to implement learning (Huang et al., 2016; Richardson, 2016). AR supplies its users with immediate feedback, which allows for real-time learning (Foronda et al., 2016; Pelargos et al., 2017).

In the field of education, AR has been reported to work well with the traditional methods that are available for learning (Joan, 2015; Wójcik, 2016). For example, additional information can be provided to students when reading textbooks by scanning an AR marker (Joan, 2015; Wang, 2016). Other benefits that have been found are that AR may increase student motivation (Lee, 2012; Richardson, 2016), help to facilitate cognitive development (Huang et al., 2016), and

aid in maintaining attention (Santos et al., 2016). These results suggest that perhaps these benefits may also be useful when applied to speech intervention.

Few studies have looked into AR in home environments. A study by Cheng and Tsai (2016) reviewed child-parent interaction during the use of an AR picture book to discover behaviors that benefited learning. The authors found that a “*child as dominator*” approach to interacting with AR was the best method to increase learning. This means that the child is more in charge of the AR book than his/her parents. The research suggests that when parent and child interact with AR, the child should have control of the technology, while parents guide them and talk through the information that is presented (Cheng & Tsai, 2016).

As with any emerging technology, professionals are cautious about AR and continuing to conduct research regarding potential concerns. Some are apprehensive about cognitive overload or overstimulation of young children and the potential for them to become addicted to a screen-dependent device (Wójcik, 2016). To avoid this, it is important to set a time limit when using AR with children, even if it is in a learning environment. One consideration Corrêa, de Assis, do Nascimento, and de Deus Lopes (2015) mentioned in their research about using a musical AR software clinically was that this new technology should be used alongside existing services and not as a replacement of them.

This project attempted to bridge the gap between what is known about the uses of AR and the best practices for parental involvement in integrating intervention goals at home. This research began to address the gap in the literature regarding the use of AR in speech intervention and identify parents’ attitudes toward using this new technology at home. The study aimed to determine if parental attitudes toward using an AR program support the use of AR in addressing home speech intervention.

Design and Methods

The project utilized an exploratory case study approach involving four different caregivers who have a child with Speech Sound Disorder (SSD). SSD is a communication disorder that affects articulation or phonological processes (Sugden et al., 2016). A case study approach allowed for an in-depth analysis and the use of multiple types of data. This project adhered to IRB protocols.

Participants

Four caregivers with a child who has SSD and receives services from the JMU Speech-Language Clinic were asked to take part in this study. Participants were selected by the researcher's advisor, who determined their suitability for the study. The members of each family who were involved in intervention strategies at home participated in this study.

Procedure

Data was obtained over the course of the fall semester, totaling 12 weeks. Caregivers selected to participate in the study were asked to attend an orientation meeting, in addition to two interviews during the study. They were asked to complete a pre- and post-survey along with weekly guided reflective notes.

Orientation. The orientation meeting provided the caregivers who participated with information regarding the study and what their role would entail. At the initial meeting, caregivers learned how the AR technology was to be used for their child's intervention practices and how to use the AR program, Aurasma.¹Aurasma, created by HP Autonomy, is a free app that

¹The Aurasma Technology was purchased in late 2017 and has been renamed "HP Reveal." For the purposes of this paper, the legacy name will be retained.

allows users to create and share videos using augmented reality (Aurasma, 2016). According to Richardson (2016), it “proved to be a reliable tool and was frequently praised for being easy to use and functioning seamlessly” (p. 41).

Recordings. Each week, the researcher met with clinicians to create recordings of the clinicians providing instruction and/or materials. The recordings were then placed into the Aurasma program and paired with a trigger image to create an “aura.” Caregivers were asked to utilize these auras when integrating intervention strategies that week. The nature and content of the Aurasma auras were determined by the child’s clinician and clinical educators. Each week, the recordings and the associated auras changed based on what each participant was practicing during their time in clinic.

Survey. Caregivers were given a pre-study survey (see Appendix A) that evaluated how involved they were in their child’s intervention before taking part in the study. To ensure that the questions were clear and understandable, the survey questions were reviewed by a parent who was not involved in the study before being given to participants. At the end of the 12 weeks, caregivers met for an additional interview and completed a post-study survey.

Reflective Notes. Caregivers were instructed on how to keep track of progress through weekly guided reflective notes (see Appendix B). There were question prompts for caregivers to answer regarding how the intervention was conducted during the week. These notes also gave caregivers the opportunity to voice any concerns or problems that arose and to give their opinion of using AR in intervention. Caregivers were asked to bring their responses to their child’s clinical session each week.

Interviews. At the halfway mark (week 5-6), caregivers met with the researcher to discuss their thoughts about the study in a scheduled interview (see Appendix C). The interview allowed caregivers to share their thoughts on the nature of study, in addition to the weekly reflective notes. At the end of the study (week 12), caregivers met for a second interview where they discussed their participation in the study overall.

Data Analysis

After gathering all the data from participants, the researcher analyzed the responses with the help of a graduate student. They looked at the differences between the pre- and post-study survey results and reviewed the responses from the reflective notes and interviews. Analysis of results involved evaluating trends in responses and noting changes in parent behavior from pre- to post-intervention. The researchers used NVivo11, a software program that analyzes qualitative data, to track responses of parent interviews and guided notes. Data were subsequently synthesized and reported based on the way each of the participants felt about the program.

Results

Pre- and Post-Study Survey Results

The majority of results from the pre- to post-study survey did not show significant change. Each participant was given the survey at the orientation meeting and provided the same survey during the final interview. Participants did not see their original answers when completing the post-study survey. Refer to Figure 1 for summary of change in response from pre- to post-study survey.

The responses from the 10-item survey were analyzed for changes between the pre-study and post-study answers. For question #1, “I accompany my child to speech intervention sessions,”

two out of four participants showed a positive change in their response, while the rest stayed the same. In question #2, “I actively participate in intervention sessions,” one participant changed her response positively, while the other three remained the same. The 9th question, “I use direct, structured tasks to integrate speech goals with my child at home (e.g. drills, word lists, games),” also resulted in positive change for two participants and showed no change for the other two.

There was a slight decrease in the answers by one item on the scale from one participant for question #4, “I find it easy to remember the instructions I have been given by my child’s clinician for practicing intervention strategies at home,” and #6, “I feel confident using materials provided for at-home use.” Two out of four participants on questions #3, “I promote my child’s speech goals at home,” #7, “There are positive outcomes to using home intervention strategies,” and #8, “I have a regular schedule for implementing intervention objectives at home,” all decreased their responses by one. Finally, #5, “I employ intervention strategies (for goals and objectives) at home with my child,” and #10, “I use indirect, informal tasks with my child at home (e.g. modeling, naturalistic situations),” showed no change from any participant from the pre- to post-study survey.

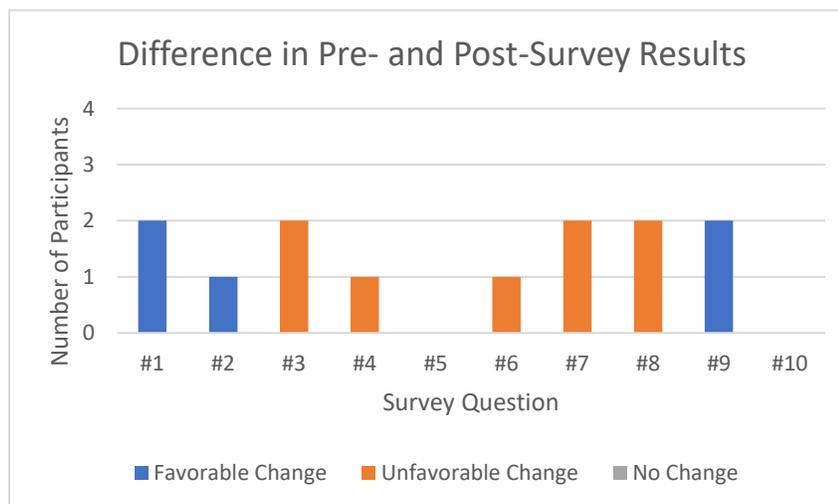


Figure 1 Change in participant response from pre- to post-study survey.

Guided Reflective Notes

Parents were asked to watch each weekly aura and provide feedback in written form using a reflective note template. They were asked to bring their guided reflections when they came to the clinic the following week. The most frequent response received from parents was that they appreciated having a video to be able to reference. They liked being able to see their child's clinician give instructions for practice at home. Parents reported that it was helpful to have a record of goals for their child and to have specific prompts to use with their child while working on intervention at home. One parent noted that having prompts provided by the clinician was helpful to her when she worked on articulation goals with her child. Aurasma gave parents, who were unable to attend each session, the ability to hear what their child is working on directly from the clinician. Being given specific activities to work on, and being able to go back to reference them, allowed parents to be more aware of opportunities to help their child. Parents expressed appreciation for the feedback provided by clinicians. Parents also reported that their children enjoyed viewing clinicians in the auras. In addition, parents suggested a way to make auras more interactive by having the clinician speak directly to their child. In this study, clinicians were not given explicit instructions regarding content; information included in the videos was up to their discretion.

There were concerns and pitfalls to using an AR technology that parents expressed in the guided notes. One parent noted that the content of the video did not require her to use it more than once. Some parents reported that the video would stop if the mobile device moved off the trigger image. This made the videos cumbersome to watch as it would require parents to restart the video. There were also concerns that misplacing the trigger image meant parents were unable to watch the aura. Parents expressed that they appreciated the video format, but wished the

videos were sent directly to them rather than needing a trigger image to proceed through Aurasma.

Interviews

The interviews gave caregivers an opportunity to address comments and concerns about the study with the researcher that could not be answered in the guided notes. They also provided an additional resource for the researcher to determine changes to be made. In the interviews, parents all expressed that Aurasma was easy to use and they felt comfortable using it at home.

Participant A. At the halfway point in the study, this parent reported that using Aurasma saved time and was more efficient than traditional session observation. She did not feel the need to sit and take notes on everything she heard during a therapy session since she was able to review what her child's clinician said in the aura later. This gave the parent the opportunity to watch the live session or observe at a more convenient time. At home, she found it helpful to watch the videos by herself first, and then watch them again with her child. She reported that watching the videos at home helped her child to realize that speech can be addressed every day of the week, not just the days when therapy is scheduled at the clinic.

During the final interview, Participant A reported that the auras allowed for a connection to the clinician throughout the week, which also helped with keeping her child engaged. While she appreciated having a video to reference, she reported the technology was not as helpful as she originally thought. She expressed concern about misplacing the trigger image and said she would have preferred a video being sent directly to her.

Participant B. During the first interview, this parent expressed that she liked being given a way to access her child's therapist away from the clinic environment. At home, she was able to

know what to work on by having her child's clinician provide video instruction. This parent preferred having a video to watch, instead of being given a summary to read. However, she found that using the trigger image was slightly inconvenient due to the possibility losing the image or having the video restart if her mobile device moved off of the image. She stated that she would rather have the video sent directly to the app or to her email.

Participant B reported that her child was engaged while watching the auras. This increased attention may have had more to do with just seeing his clinician rather than reviewing the actual content of the video. When asked if she would use a program similar to this in the future, she reported that she would be open to using this technology again but would not inquire about it if the clinic did not already have something in place.

Participant C. The major concern expressed by this parent was the auras restarting if the mobile device was moved off the trigger image. He expressed that he liked being given a way to know what specific activities to integrate at home and to know his child's goals for the week. Having the auras to review gave him a chance to go over the goals again at home. However, he stated that he did not know if any improvements made were a result of using Aurasma or just due to the content of the videos. He appreciated being able to share the videos among multiple people, giving family members who were not present a way to stay involved in the intervention process. As a result of the content the auras provided during this study, Participant C stated he would be more inclined to ask his child's clinician for activities he can work on at home, in addition to hearing more about goals addressed during the session.

Participant D. The overarching response from this parent during both interviews was how much she appreciated the consistency the auras provided. She liked having an opportunity to go back and review the goals being addressed, so she could implement them throughout the

week. The auras allowed her to know exactly how her child's clinician was providing prompts and questions, which allowed her to keep instruction consistent when working with her child at home.

Conclusion

Overall, the parents who participated in the study appreciated having a way to supplement intervention at home. Parental response to using Aurasma was positive, as many stated they would be willing to use Aurasma, or similar programs, in the future. Parents reported that having videos to reference were helpful. The videos allowed them to follow what their child was working on in therapy and gave them activities to incorporate at home. The videos also provided a resource to inform family members (who were unable to observe the sessions) of intervention goals and activities.

In the future, using Aurasma, or other AR programs, would be helpful to clinicians as a way to expand the inclusion of families in the intervention process. Having this medium allows clinicians to send activities and instructions home with families for further explanation and practice. Additionally, AR could promote generalization across settings by allowing clients and their families to address intervention goals outside of the clinic.

Limitations of the Present Study

There were some limitations to the present study that warrant consideration. The results of this study cannot be generalized to the overall population since the study focuses on a small sample size of only four case studies. A small sample size was used to provide researchers with a starting point to suggest best practice in the future based on the results obtained from participants in this exploratory study. Families were chosen by the researcher's advisor and they were known to the researcher before the beginning of the study, as they are families presently enrolled in the

JMU Speech-Language Clinic. Instead of creating a random sample, researchers identified participants who expressed a willingness to dedicate the time needed to participate in this study. Participants needed to have access to a smartphone or mobile device in order to access the AR program. It is important to note that feedback from the parents was not consistently submitted by all parents due to travel or illness. Therefore, the number of auras created for each participant varied across the study.

Clinical Implications and Future Directions

Aurasma could be used clinically to promote generalization across settings by giving parents and caregivers a medium to address intervention goals outside of the clinic. AR programs also allow families to have something concrete to bring home with them. Instead of solely relying on memory to recount what their child's clinician said to them before or after a session, families could have direct instruction from clinicians through a video that can be accessed anywhere. The reason for using Aurasma versus solely emailing a video is the security it provides. Users must have the correct trigger image to access the content of the aura, so information about each client can be shared with parents while still being kept in a confidential format.

In future studies, it would be prudent to expand the study to include more participants and more diverse intervention types. This study had a small sample size and included only clients who presented with Speech Sound Disorders. However, this technology could possibly benefit clients with other speech and language disorders, as well. Clinicians involved in this study were given the freedom to decide the types of activities and support they wanted to include in their auras. This was practical, but it resulted in the format of each client's auras to differ slightly. In

the future, providing clinicians with more explicit guidance regarding specific content to be included in each aura may enhance the benefit of AR use at home.

A concern expressed by parents in the study was the fact auras restarted when devices were moved off of the trigger image. Given continued research with Aurasma, researchers should ensure that auras continue to play even when mobile devices are removed from the trigger image. Finally, parents feared that having a different small sized trigger image each week would increase the possibility of the images becoming misplaced. To help prevent this potential frustration, one option may be to incorporate the AR image as part of the child's written session documentation. By placing the trigger image on the lesson plan for each session, the parents have a record of session goals along with video instructions from their child's clinician. This would serve as a more effective way to organize trigger images for possible future review.

References

- Aurasma. (2016). Retrieved April 15, 2017, from <https://www.aurasma.com>.
- Bowen, C. and Cupples, L. (2004). The role of families in optimizing phonological therapy outcomes. *Child Language Teaching and Therapy*, 20, 245-260.
- Cheng, K. H. & Tsai, C. C. (2016). The interaction of child-parent shared reading with an augmented reality (AR) picture book and parents' conceptions of AR learning. *British Journal of Educational Technology*, 47(1), 203-222. doi: 10.1111/bjet.12228
- Corrêa, A. D., de Assis, G. A., do Nascimento, M., & de Deus Lopes, R. (2015). Perceptions of clinical utility of an Augmented Reality musical software among health care professionals. *Disability and Rehabilitation: Assistive Technology*, 1-12.
- Foronda, C. L., Alfes, C. M., Dev, P. Kleinheksel, A. J., Nelson, D. J., O'Donnell, J. M., & Samosky, J. T. (2016). Virtually nursing: Emerging technologies in nursing education. *Nurse Educator*, 42(1), 14-17.
- Günther, T., & Hautvast, S. (2010). Addition of contingency management to increase home practice in young children with a Speech Sound Disorder. *International Journal of Language & Communication Disorders*, 45(3), 345-353. doi: 10.3109/13682820903026762
- Huang, Y., Li, H., & Fong, R. (2016). Using Augmented Reality in early art education: A case study in Hong Kong kindergarten. *Early Child Development and Care*, 186(6), 879-894.
- Joan, D. R. (2015). Enhancing education through mobile Augmented Reality. *Journal of Educational Technology*, 11(4), 8-14.

- Lee, K. (2012). Augmented Reality in education and training. *Techtrends: Linking Research & Practice to Improve Learning*, 56(2), 13-21. doi: 10.1007/s11528-012-0559-3
- Pelargos, P. E., Nagasawa, D. T., Lagman, C., Tenn, S., Demos, J. V., Lee, S. J., & ... Yang, I. (2017). Review article: Utilizing virtual and augmented reality for educational and clinical enhancements in neurosurgery. *Journal of Clinical Neuroscience*, 35, 1-4. doi: 10.1016/j.jocn.2016.09.002
- Richardson, D. (2016). Exploring the potential of a location based Augmented Reality game for language learning. *International Journal of Game-Based Learning*, 6(3), 34-49.
- Santos, M., Lübke, A., Taketomi, T., Yamamoto, G., Rodrigo, M., Sandor, C., & Kato, H. (2016). Augmented reality as multimedia: The case for situated vocabulary learning. *Research & Practice in Technology Enhanced Learning*, 11(1), 1-23. doi: 10.1186/s41039-016-0028-2
- Sugden, E., Baker, E., Munro, N., & Williams, A. L. (2016). Involvement of parents in intervention for childhood speech sound disorders: A review of the evidence. *International Journal of Language & Communication Disorders*, 51(6), 597-625. doi: 10.1111/1460-6984.12247
- Walker, J. T., Hoover-Dempsey, K. V., Whetsel, D. R., & Green, C. L. (2004). Parental involvement in homework: A review of current research and its implications for teachers, after school program staff, and parent leaders. *Harvard Family Research Project*, 1-9.
- Watts Pappas, N., McLeod, S., McAllister, L., & McKinnon, D. H. (2008). Parental involvement in speech intervention: A national survey. *Clinical Linguistics and Phonetics*, 22, 335-344.

- Watts Pappas, N., McAllister, L., & McLeod, S. (2016). Parental beliefs and experiences regarding involvement in intervention for their child with Speech Sound Disorder. *Child Language Teaching and Therapy*, 32(2), 223-239.
- Wang, L. L. (2016). Gunner Googles: Implementing Augmented Reality into medical education. *Studies in Health Technology and Informatics*, 220, 446-449.
- Wójcik, M. (2016). Potential use of Augmented Reality in LIS education. *Education and Information Technologies*, 21(6), 1555-1569.

Appendix A

Survey (adapted from Walker *et al.*, 2004):

On a scale of 1-5 (1=strongly disagree with the statement, 2=somewhat disagree with the statement, 3=unsure of the statement, 4=somewhat agree with the statement, 5=strongly agree with the statement) rate the following:

- | | | | | | |
|---|---|---|---|---|---|
| 1. I accompany my child to speech intervention sessions | 1 | 2 | 3 | 4 | 5 |
| 2. I actively participate in intervention sessions | 1 | 2 | 3 | 4 | 5 |
| 3. I promote my child's speech goals at home | 1 | 2 | 3 | 4 | 5 |
| 4. I find it easy to remember the instructions I have been given by my child's clinician for practicing intervention strategies at home | 1 | 2 | 3 | 4 | 5 |
| 5. I employ intervention strategies (for goals and objectives) at home with my child | 1 | 2 | 3 | 4 | 5 |
| 6. I feel confident using materials provided for at-home use | 1 | 2 | 3 | 4 | 5 |
| 7. There are positive outcomes to using home intervention strategies | 1 | 2 | 3 | 4 | 5 |
| 8. I have a regular schedule for implementing intervention objectives at home | 1 | 2 | 3 | 4 | 5 |
| 9. I use direct, structured tasks to integrate speech goals with my child at home (e.g. drills, word lists, games) | 1 | 2 | 3 | 4 | 5 |
| 10. I use indirect, informal tasks with my child at home (e.g. modeling, naturalistic situations) | 1 | 2 | 3 | 4 | 5 |

Appendix B

Guided Reflective Notes (adapted from Brown, 1997):

- Describe your use of the program today.
- What was the goal of today's program?
- Did anything happen during the program that surprised you?
- What are some things from the program that you liked?
- What are some issues/concerns that you have?
- What did you learn from this program?
- How helpful is the media in understanding today's goal?

Appendix C

Interview Questions:

1. How comfortable do you feel using Aurasma?
2. Describe your experience using Aurasma for at-home speech intervention.
3. How has your experience using Aurasma been different from other at-home interventions?
4. What has your child's response to using Aurasma in at-home speech intervention been?
5. How has your child's at-home speech intervention changed by using AR?
6. How did this experience impact whether you will use Aurasma for at-home intervention in the future?
7. Do you have any questions or concerns at this time?