

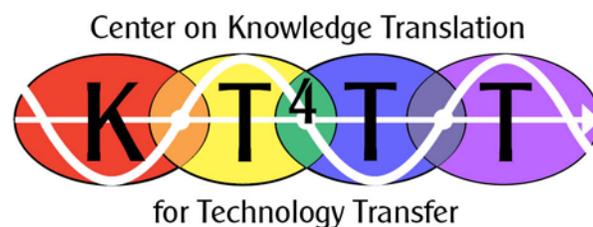
Industry Profile on Technologies for Cognitive Impairments

Part I:

Insights from Industry

*A guide for grantees and inventors who are developing
products and apps to meet the needs of people with cognitive
impairments*

by



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Table of Contents

I. Executive Summary	1
II. Knowledge Value Mapping – Protocols and Results.....	3
Participants	3
Experience with Grants and Grantees	3
Barriers to Successful Collaboration	4
Opportunities for Collaboration	4
Considerations for University-based Researchers Seeking Collaborative Relationships.....	5
Get More Information.....	10
III. Conducting Market Research- Advice from Industry	10
Defining the Market: Beneficiaries, Users, Buyers, and Payers.....	10
Segmenting and Estimating Market Size	12
IV. Currently Unmet Needs: Opportunities for Independent and Collaborative R&D	12
1) AbleNet’s Take	12
2) Don Johnston’s Take	15
3) AbleLink’s Take	16
V. Manufacturers’ Comments Regarding Apps	17
VI. References	19
VII. Contact Information for Participating Companies.....	20

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I. Executive Summary

We interviewed the presidents of three companies who develop and market products for people with cognitive impairments: Ruth Ziolkowski from Don Johnston, Jennifer Thalhuber from AbleNet, Inc., and Daniel Davies from AbleLink Technologies. These participants shared their views on working with federally funded grantees and inventors who are external to the company. Topics of discussion included when and how grantees and inventors should approach potential industry partners with their project ideas, and what kind of information they should bring to that first meeting. They also shared their perspectives regarding the most pressing unmet needs in the cognitive impairment industry. Here are a few highlights of advice that these AT manufacturers have for grantees and inventors.

Grantees and inventors should:

- *Contact potential industry partners early in the research and development process.* Early contact is the best way to ensure a good fit between your efforts and the company's interests, and manufacturing and distribution capabilities.
- *Perform due diligence* prior to initial contact with a company so that you can answer the following questions:
 - How is your proposed product superior to existing alternatives?
 - What is the size of the market for this product?
 - When you are defining the size of the market for a product, focus on the number of people who have specific functional limitations, rather than particular medical diagnoses.
 - Remember that product users are not necessarily buyers. For example, buyers of products for people with cognitive impairments may include family members, care providers, therapists, or schools/ districts.
- *Maintain realistic expectations* regarding the value of your intellectual property in relation to the effort required to complete the entire new product development process.

What are the most pressing unmet needs facing the cognitive impairment industry segment?

Participants were asked to describe which unmet needs in the cognition industry were most pressing. Responses included:

- A need to better leverage mainstream technology's existing capabilities, and to create technology to bridge assistive devices and mainstream consumer products (see page 14).
- A need to increase the implementation of existing technology in classrooms, and to help educators understand and better tap into their students' potential (see page 14).
- A need to increase awareness of existing technology (see page 16).

Opportunities for Collaboration

We asked participants if they would be interested in working with grantees and inventors, and all responded with a resounding "Yes!" The following opportunities are just the tip of the iceberg when it comes to collaborating with assistive technology manufacturers. Consider these ideas to get you thinking about how you can collaborate with these companies, or any of the hundreds of other assistive technology companies in the US. Contact information for the participating companies is provided on page 19.

Specific opportunities include:

- AbleNet may be able to offer assistance in navigating Apple's "Made for i" (MFi) program. This licensing program allows developers and manufacturers outside of Apple to gain access to hardware components, development and testing tools, logos, certification, etc. For information about the MFi program, visit: <https://developer.apple.com/programs/mfi/>
- Don Johnston sees opportunities for researchers to evaluate the efficacy of existing products. They have also identified gaps in classroom assessments, where researchers could lend expertise.
- AbleLink can help researchers develop technology for use in intervention studies.

II. Knowledge Value Mapping – Protocols and Results

A knowledge value mapping exercise was conducted to better understand how grantees can best collaborate with industry partners to commercialize new devices. The knowledge value mapping technique considers the needs and interests of knowledge users so that research and development outputs can be tailored to maximize uptake and use (Bozeman & Rogers, 2002). Presidents from a sample of AT companies were asked to describe their company's past interactions with grantees on collaborative projects. Interviews then explored how the companies would like to work with grantees and inventors, including the best ways for external parties to initiate contact and maintain collaborations with potential industry partners. Lastly, the discussion turned to consider unmet needs amongst people with cognitive impairments, and how grantees might lend their expertise to help the companies address those needs.

Participants

Assistive technology companies that manufacture products for people with cognitive impairments were identified through web searches, the Assistive Technology Industry Association member directory, and an expert interview. Inclusion criteria stipulated that participating companies must develop and produce their own products, thereby excluding companies who exclusively operate as resellers. In total, presidents or CEOs from three companies were interviewed. The companies were AbleLink, AbleNet, and Don Johnston.

Experience with Grants and Grantees

All participants had some experience working with university-based collaborators and submitting their own proposals for grant funding. The Small Business Innovation Research (SBIR) program was the primary funding mechanism used by the companies to acquire resources for technology development. Some SBIRs involved collaborations with external partners, such as university-based researchers. However, most of the participants' university/industry collaborations were fueled by NIDILRR Field Initiated grants or Small Business Technology Transfer (STTR) grants. Collaborative efforts were conducted with Rehabilitation Engineering Research Centers, school districts, and university-based engineering departments

or rehabilitation engineers. In many cases, when funding was acquired by a university-based researcher or small business technology developer, the funding sources were transparent to the industry partner. Through these experiences a variety of new devices and software programs were developed and launched. The following sections detail the manufacturers' perspectives on working with grantees to develop new products.

Barriers to Successful Collaboration

Participants noted many challenges that arose from working with university-based grantees and independent inventors, ranging from logistics issues to mismatches in timeframes and expectations. For example, in one case it was difficult for a company to buy time from a university so that a researcher could collaborate on an STTR. A more common problem is the significant difference between industry and university timeframes for project completion. Grants often run for a number of years, while investigators slowly perfect their inventions. In contrast, industry must quickly deploy new products and remain responsive to the rapid pace of technological change. While an external inventor or grantee's product idea may have value, companies have their own internal idea streams. The time-lag can result in a company refocusing resources on new projects before the university collaborator has been able to finalize their planned contribution.

Mismatches in expectations present another challenge. Universities may underestimate the cost to market and sell a product, while overvaluing their own contribution. This problem can be especially challenging when dealing with software code. Universities typically want to share in profits from code developed at their institutions, but the industry partner is often left with the responsibility of updating the code to work with new hardware and ever-changing operating systems.

Opportunities for Collaboration

Participants noted many opportunities for collaboration with industry partners. Grantees can fill gaps by applying their research expertise to help create the needed evidence base for existing and upcoming products. Opportunities range from conducting field tests of devices (AbleLink), which may be paid for by the industry partner when the testing is evaluating their

products; to evaluating the efficacy of products, which must typically be undertaken by the researcher without compensation from the company in order to avoid conflicts of interest that could bias results (all participants). Don Johnston often contacts experts for assistance by finding researchers who are highly visible with their work in the field. They also welcome contact from researchers who would like to establish a dialogue.

Considerations for University-based Researchers Seeking Collaborative Relationships

Intellectual Property

Early discussions. The participants agreed that intellectual property ownership is a complex matter, particularly in interactions with universities. Discussions typically begin with inventors sharing non-proprietary information. Once a potential industry partner has shown interest in the idea, non-disclosure agreements may be signed to protect the inventor's ownership rights. At this point, a university's Technology Transfer Office (TTO) may be brought in to handle discussions and documentation related to intellectual property.

The long time frames often needed to establish agreements with universities provide another compelling reason to begin intellectual property discussions early on. One participant stated that it can take anywhere from three months to a year to come to a mutually-satisfying agreement. From the industry partner's perspective, this may translate to missed opportunities in the marketplace. Therefore, inventors are encouraged to begin these discussions as early as possible so that agreements can be reached before a market opportunity is missed, and before interest in the proposed intellectual property fizzles.

Importance of exclusivity. One participant stated that exclusive rights to intellectual property are of great importance. From a business management perspective, it makes sense that a company would not want to invest time and resources in developing a product if the owner may later shop it to other potential licensees. Therefore, if an inventor is not happy with proposed royalties or a proposed licensing agreement, then they would be encouraged to take their time to do their due diligence in exploring other options.

Joint development considerations. When working on collaborative projects, early discussions should clarify who is bringing what to the table, and who has intellectual property ownership at the end of a project. Many universities present agreements that dictate that they would own the technology at the end of a project. However, such agreements are not favorable for the collaborating industry partners, and would be considered deal-breakers. Intellectual property is the lifeblood of companies, and inventors and TTOs must be aware of the implications of the agreements they are attempting to put in place.

Realistic expectations. It is important for inventors and university TTOs to remain mindful of the relative investments made by each party involved in developing and commercializing a technology. Inventors often have an inflated sense of what their contribution is worth, while it is the industry partner who must make significant investments to move the idea through research and development, sales and marketing, manufacturing, and distribution, while also providing after-sales service. Companies often find that they must educate inventors and TTOs regarding the value of early-stage ideas. Therefore, it is in everyone's best interest to enter into discussions with realistic expectations for how much a seed idea or an early-stage prototype is worth.

One participant stated that they often turn away inventors who have an idea but lack an understanding of how much work must go into realizing a commercialized device. The companies themselves have plenty of ideas, and consider that to be the easy part. When an inventor has an idea, and high expectations, it's not worth the company's time to work through it with them. In assistive technology, markets are small and rarely is anyone going to become a millionaire. Often, proposed ideas simply lack market potential.

The type of intellectual property agreement used by one participant's company depends on where the development effort stands. For example, if the company is taking on all of the front-end risk and becoming the primary investor, the company may offer a royalty to the inventor. However, if the inventor has already done a great deal of front-end feasibility work, the company may seek a licensing agreement.

The Importance of Due Diligence

Inventors often approach companies hoping to receive large royalties for their idea. However, an idea must not only be technically feasible to produce, but must also make business sense. Inventors should keep in mind that companies have their own internal idea-streams. A company will not be willing or able to do a great deal of unfunded work to further develop an idea unless its market potential has been demonstrated, and it is within the company's capabilities to actually produce and sell the product.

Time and again, inventors are unaware of the state of the art, and pre-existing competing products that are already available. One participant stated that Inventors often do not take the time to study the market, and eight times out of ten, the industry partner can point to equivalent solutions that the inventor was not aware of. Staying close to industry to know what is already on the market is critical. Further, industry partners need inventors to demonstrate how their product is better than existing ones.

When a product has been built for a particular application, the inventor and the industry partner must look at the market opportunity and determine if the product solves a problem or creates other problems.

Inventors must also be conscious of a company's strengths and capabilities. It is unrealistic to expect that a company would start an entirely new division to produce a product. One participant stated that they are specifically interested in evolving their current products into blockbuster products- rather than introducing entirely new products. It takes time to create a blockbuster -- perhaps as long as five years of continuous investment. In this case, developers and researchers should initiate collaborations as early as possible to ensure there is a good fit between their work and the partner's needs.

Timing: When to Approach a Potential Industry Partner

All participants agreed that open communication from an early stage is helpful, and none were opposed to having an inventor initiate contact early on. Two companies would prefer to be involved in projects from a very early stage. One participant stated that they preferred

involvement from the funding proposal stage, so that they can help to ensure that realistic timelines and budgets are in place. Early contact is also helpful in cases where the device under development will dovetail with products that the company is already offering. This allows the company to ensure that any interfacing details are worked out at the beginning.

However, one participant had a differing opinion regarding optimal timing for initial contact. They stated that it was helpful to have the prototype developed beyond the alpha stage, and closer to the beta stage, after potential end users have provided feedback on the device being used as intended. This participant stated that they prefer to let the inventor handle the front-end activities, and they have found that university-based partners take time to make sure they're "getting it right." Therefore, the company likes to let inventors work autonomously to move the technology forward, and then assume control when the inventor is comfortable with the industry partner owning the technology. In the participant's ideal scenario, the inventor would hand-off a device that the company has to optimize for manufacturing, move to manufacture, handle the license/ royalty agreement, and then move to mass market.

The takeaway here is that although preferences regarding timing for initial contact differ somewhat, it is in the best interests of grantees and inventors to make early initial contact. During the opening discussions, expectations can be clarified regarding when to follow up, and when to expect serious discussion of the actual transfer of intellectual property to occur. Once the industry partner's preferences are known, the grantee or inventor should be mindful to respond accordingly. This will increase their chances of executing a successful partnership.

Initial Contact

What to share. First and foremost, an inventor must be able to share information about the technology. They should be able to describe what problem it solves, what it does to help the user, and how it is superior to other existing alternatives.

It is very helpful when an inventor has done market sizing based on functions that the product performs, rather than specific disability categories. That is, compile numbers as they relate to

functions and the solution the product provides, versus how many people in the world report that they have a particular condition.

One participant stated that they would like to be involved in early stage market research to improve their confidence in the results. With that being said, there is an expectation that the inventor will conduct some of the market research activities.

How to share. All participants agreed that phone calls, emails, and in-person interactions (perhaps at a conference) are good ways to initiate contact. One participant also stated that they often follow up with Skype interviews so they can see the product and its application face to face.

How Can Industry Partners Help Researchers and Technology Developers?

All three participant companies -- AbleLink Technologies, AbleNet, Inc., and Don Johnston -- stated that they are interested in collaborating with external partners such as NIDILRR grantees. The following bullets represent a few of the ways that grantees and inventors might partner with industry.

- *Vetting market opportunities.* One participant stated that they would be willing to help examine market opportunities for proposed devices. They would also be willing to help researchers find potential end users for needs analysis and/or testing purposes. They can help connect researchers with persons who have specific conditions – domestically and internationally- so that the researcher can see how well their product works for people with different conditions.
- *Exploring international sales potential.* If the industry partner already has an international presence, they will be able to investigate how to get the product funded in different countries.
- *Quick quotes.* Industry partners typically have established relationships with suppliers and manufacturers. They can move quickly (within 48 hours) to gather tooling quotes, board concepts, and costs to build.

- *Navigating Apple’s MFi requirements.* One participant stated that they are well-versed in Apple’s MFi requirements, and can help developers to quickly make sense of the process.

Get More Information

See [III. Conducting Market Research- Advice from Industry](#) for details on defining your target market, and [IV. Currently Unmet Needs = Opportunities for Independent and Collaborative R&D](#) on page 14 to review the manufacturers’ perspective on the gaps that remain in meeting the needs of people with cognitive impairments. Also visit [V. Manufacturers’ Comments Regarding Apps](#). This section offers tips for grantees and inventors who are currently, or wish to be engaged in app development.

III. Conducting Market Research- Advice from Industry

Defining the Market: Beneficiaries, Users, Buyers, and Payers

Many researchers struggle to find the best way to define the marketplace for the outputs of their research and development projects. Part of the problem comes from disability statistics, which typically report the number of people who have a particular diagnosis. However, product sales are not necessarily tied to medical diagnostic categories. They are instead related to the person’s functional limitations and abilities, which may be related to one or more medical diagnoses. The company representatives who participated in this knowledge value mapping exercise shared their insights on how to quantify the market size for products.

Beneficiaries

All participants stated that functional limitations are the best descriptors for the beneficiaries of cognitive technologies. One participant was careful to note that cognitive ability is a broad spectrum, and everyone is somewhere on the continuum, regardless of disability. Everyone has cognitive ability, and most likely wishes that they had more. In our everyday lives, all people who use devices such as cell phones that store phone numbers and provide electronic event reminders have benefitted from augmentation of their cognitive ability.

Product Users and Buyers

Generally speaking, products are not sold directly to people with cognitive disabilities. Instead, intermediaries make purchases on behalf of the person. In the case of home-use products, a parent, caregiver, or agency may make the purchase. As an example, someone with a developmental disability may need a prompting system. The individual is unlikely to go out and look for it. It will be the family, or an agency that is providing services that will locate and purchase the product.

Two participants were immersed in educational environments, and stated that their target market consists of the professionals and educators who will use their products with children and/or students. In these cases, the market may consist of educators, physical therapists, occupational therapists, assistive technology specialists, speech language pathologists, rehabilitation engineers, and/or rehab staff in clinical and school settings. Although some places throughout the US are looking at school-based accountability, it is not always practical for a company to target individual buyers, such as school principals. In these cases, the market may be addressed at a higher level, by targeting district-level buyers and special education directors.

Companies who sell to US-based schools may also enter into international markets, although purchasing practices can be very different from one country to another. Companies must look at the investment required relative to the potential return of reaching a particular market. This is true for international markets as well as the fringes of US markets. For example, some companies may have a K-12 focus, but will still consider the costs and potential return of serving the fringes, such as pre-K and college-age students.

Payers

One participant stated that most purchases are not made from the beneficiary's own funds. Instead, insurance tends to pay for their company's products. Many purchases are made by school districts with school funding, with funds from different federal, state or district pools. Medicare, Medicaid, and private pay insurance are also payers, although products tend to fall in "other" or "waiver dollars" categories. An inventor attempting to license a technology to an established company does not have to be particularly mindful of who is paying, as the industry

partner will be familiar with the markets and their funding systems. However, these considerations will be very important to inventors who are attempting to create new start-ups.

Segmenting and Estimating Market Size

To estimate the size of a particular market, one participant stated that they might look at the total population of people who have an impairment or ailment, and use that statistic to estimate how many therapists or educators they can reach in a particular region. These figures would allow the company to ascertain the feasibility of marketing directly to those professionals or educators, who can then reach the students. Companies have internal ratios for determining the percentage of markets that may benefit from a particular product. For example, low-tech versus high-tech products will likely have different target markets. Based on their own experience serving those markets, the company can estimate potential sales.

IV. Currently Unmet Needs: Opportunities for Independent and Collaborative R&D

Knowledge value mapping participants were asked a series of questions related to the most pressing unmet needs of people with cognitive impairments. Responses included: 1) a need to better leverage mainstream technology's existing capabilities, and to create technology to bridge assistive technology devices and mainstream technology; 2) a need to evaluate the efficacy of existing technology, and to make new tools easier for teachers to implement in classrooms; 3) and a need to increase awareness of existing technology amongst those who serve and/or care for people who have cognitive impairments. The following provides additional details regarding each of these unmet needs from the manufacturers' perspectives.

1) AbleNet's Take:

There is a need to better leverage mainstream technology and create new technologies to bridge mainstream and AT solutions.

What is the gist?

The industry is working to recognize the fit and capabilities of mainstream consumer devices to meet the needs of people with significant physical and cognitive impairments.

Why is this important?

There are huge advantages, for the user and those around them, when people with disabilities use technology that is familiar, because the people around them are able to support the use of that technology. By leveraging mainstream technology, we can break down barriers for everyone to participate in supporting a user 24/7. If someone is using an unfamiliar device, others around them become less involved in support. This leaves the user to rely heavily on company-based technical support, which will always be less available than the consumer-user community.

What are the problems?

People with disabilities can't always access technology in the same way as their non-disabled peers.

- We need ways to bridge consumer-ready devices with other assistive hardware devices and/or input and output solutions.
 - New operating systems are offering sophisticated settings for people with physical and cognitive disabilities to use their devices in ways that foster independence. However, people need input/output options that allow them to interface with those operating systems.
- Mounting capabilities for these devices are missing from the marketplace.
- We need to bridge the sophistication of consumer-ready devices with different levels of physical and cognitive ability.
- Funding is needed for people to acquire technology outside of school settings.
- We need to create awareness of the availability of technology amongst those who serve people with cognitive impairments.

In what environments are the problems encountered?

After primary and secondary school. Without needed technologies, people with disabilities often make behavioral accommodations, such as simply disengaging. This is frequently a problem when individuals are moving out of the K-12 environment, where they had previously

been highly engaged. After they graduate, individuals may move into a group home setting, where case managers are unfamiliar with the individual's capabilities and lack the resources to provide needed technology.

In workplace settings. Mainstream technology such as tablets could be used in the workplace to help employees understand the steps necessary to complete tasks. Instead of repeatedly going to the manager and asking them how to do a task, the individual could use a tablet with a program that could allow them to view and replay process steps as often as needed. In this case, the use of mainstream technology would make the accommodation more readily available and apparent to the employer.

What are the main challenges in addressing these unmet needs?

On the end user side, securing funding to get technology, particularly accessories, into the hands of consumers is difficult. For manufacturers and technology developers, the biggest challenge lies in the rapid pace of consumer device development and deployment. The form factor of devices frequently changes, making it difficult to create bolt-on accessories. Outside of Apple, there are no overarching protocols that are followed. So, devices may change enough to make an AT add-on accessory obsolete before the manufacturer has even had a chance to recoup their investment.

Where are opportunities for researchers to contribute to meeting these needs?

Manufacturers don't have all of the answers to what new technology may help someone with a cognitive disability. If we cast a wide net in search of new ideas and concepts, the chances of discovering meaningful and game-changing technology becomes possible. Therefore, researchers should continue to identify problems and seek solutions, while manufacturers do the same. Together, we then have a stronger likelihood of developing technology that can make a meaningful difference, while remaining commercially viable.

2) Don Johnston's Take:

There is a lack of technology adoption, partially due to the gap between the students' abilities and the teachers' assumptions of the students' ability.

What is the gist?

We have produced a new reading curriculum for students with cognitive disabilities, and have used it in many classrooms with great success. The problem is that the customer feels their students cannot do this level of work. Basically the market drives us to "dumb down" the product to get maximum market acceptance. In addition, core genres of tools such as word prediction remain unused, despite being proven to work with students with cognitive disabilities. Teachers are asking for students to continue to trace and copy and are not giving students tools that can highlight their abilities.

Why is this important?

Schools choose more of the same type of solutions that are comfortable for teachers first. So if teachers are not comfortable with technology, it will not be used, even if a student may need it.

What are the problems?

The number one driver we have found for whether a new curriculum is adopted is the teacher's willingness to use it. What this means is that for teachers to be willing to use a curriculum, we have to use their current assumptions of what their students can do as the core functionality. In addition, there is still a significant lack of technology in special education classrooms in particular. It is rare to hear of 1:1 initiatives for classrooms with students with cognitive disabilities. Even when a school district has a 1:1 initiative, it typically does not include special needs classrooms.

In what environments are the problems encountered?

These problems exist in K - 12 and beyond.

What are the main challenges in addressing these unmet needs?

Beyond assumptions, there is still a significant lack of technology. In addition, there is also a critical lack of implementation and use. There is a need for more front-end assessment, and for

back-end evaluation to ensure fidelity of implementation. That means determining whether the technology/curriculum is being used, and if so, how much?

What conditions are needed for those advances?

Stimulus funding helped to get technology into schools years ago. At the time, when the money was there, people were thinking bigger and broader, and more systematically. Now schools are back to feeling broke and putting this population last. Some classrooms barely have classroom libraries of books. If there are books, typically they are not age appropriate. There is also a lack of training for educators. Often if there is training it is once and done. Annual training should be provided to teachers, and there should be more ways to hold people accountable. We have to get to a one-to-one match between students and technology.

Where are opportunities for researchers to contribute to meeting these needs?

Research is needed to assess the efficacy of the products that are currently available. Then, there is a need for researchers to independently use that information to make the case to policymakers for why funding is needed- including stimulus funds for the infrastructure, technologies, or systemic change that would lend itself to more systematic review of classroom needs. There are also some gaps regarding assessments where researchers could lend their expertise.

3) AbleLink's Take:

There is a need to create more awareness of available technology.

What is the gist?

The biggest problem in the cognitive technology marketplace is the lack of awareness about existing cognitive technologies. Many technologies that have been designed to meet cognitive needs. But many of those are not used extensively by people who need them. A lot of the problem stems from a lack of awareness on the part of the organizations and professionals in that field. They often just don't know what technology is out there. So, the biggest need is to match an individual's needs with technologies that already exist. That is more critical than creating new technology.

Why does this problem persist?

Supporting people with cognitive impairments is a very service-oriented industry where caregivers are paid to help people perform the activities of daily living. However, the caregivers are typically not technologists, occupational therapists, or AT specialists who would be more likely to maintain an awareness of helpful AT solutions.

As a result, the cognitive area is not one where people look for technology-based solutions. In contrast, if someone has a mobility problem, then they look for things that help with mobility. Or, if a person has problems accessing a computer because of physical limitations, then they would look for switches and alternate input devices. There is this mindset that we have technology out there that can help with that. But, that's not yet the mindset when it comes to the cognitive area. Even the agencies that provide services often don't think about what technology is in the toolbox, and instead default to using caregivers to help accomplish tasks.

What is needed to increase awareness of existing technology?

Just a few years ago, a big media campaign talked about how many people had autism. It created public awareness about autism, which hadn't been there before. A similar, mainstream media campaign could help to create awareness of the technology that is currently available for people with cognitive impairments.

In addition, stories should be leveraged as powerful communication tools. It can be tremendously helpful for a caregiver to actually see someone with a cognitive disability successfully utilizing technology to perform activities of daily living or to engage with their community. The message can then be conveyed through video that can be viewed wherever the caregivers may be, whether it's at a professional conference, or on TV, ideally in the mainstream media, or simply a YouTube video that catches fire.

V. Manufacturers' Comments Regarding Apps

Apps that run on computers, tablets and cell phones offer tremendous potential for the cognitive impairment industry. However, there are also many challenges and limitations associated with apps. First, the delivery system for apps, through mainstream mobile devices, is

very helpful. Not only are the devices widely available, but people with and without disabilities are typically familiar with the technology. The distribution system for the apps is also very easy to use for both the app producer and the consumers.

One major downside to apps is the expectation that all apps are low cost. It is difficult, if not impossible, for a business to be successful with an app that is sold to a niche market, because the revenue will not cover development costs. There is also an assumption that apps will work for a lifetime, although they are usually a one-time purchase. When device manufacturers update their hardware every few years, customers pay for new devices. However, when apps are updated, customers expect updates to be included in the initial purchase price. This means that there is no revenue stream to pay for updates.

The app marketplaces may also charge fees and royalties, which further reduce potential app income. For example, Apple charges a high royalty, which is taken off the top of every download. While it's possible that insurance may eventually pay for apps, there will have to be changes in the payers' regulations. One of the biggest problems is dedicated device requirements. For example, an iPad is not a dedicated assistive technology device. As such, it may be difficult or impossible to obtain payment from third party payers for the app or the device itself.

The future of apps may depend on using and marketing them in new and unique ways. For example, using business-to-business models, where the apps are combined with some other service offering, such as a cloud service. Or, instead of monetizing an app, it could be used as a marketing tool.

One of the biggest challenges for app developers is the after-launch code maintenance. As Apple, and other device manufacturers continue to improve their operating systems, app developers must keep pace with those changes. This in turn requires the developers to invest more time and money to maintain already published apps. If a developer has not successfully matched the purchase value of the app with the long-term code maintenance costs, those costs can easily exceed the revenue generating potential of the app. All apps, even those that are

considered to be marketing tools experience this problem. For the apps to remain operational in the long-term, ongoing investment costs should be considered up front.

App developers who are creating programs for people with cognitive impairments are encouraged to contact AbleNet to discuss potential collaborations, and explore the various opportunities and challenges associated with successfully maintaining and supporting the app lifecycle.

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VII. Contact Information for Participating Companies

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Also check out the Resources page on the KT4TT website for a listing of AT companies:
<https://sphhp.buffalo.edu/cat/kt4tt/technical-assistance-and-resources.html>