

A Multimedia Literacy Tool for Students With Autism

(An Out-of-Budget Project Report, 6/30/2011)

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Overview

The objective of this out-of-budget project was to research and develop a prototype Web-based interactive assistive tool to help high functioning students (those close to grade level) in grades 4-6 with autism engage in inquiry-based science learning. Research and development took place over the 12-month period between June 2010 and June 2011 and included the following goals:

- 1) Design and develop a proof-of-concept interactive multimedia literacy tool.
- 2) Study the usability of the tool and begin to identify the degree to which it offers autistic learners access to standards-based science content.

Project Partners

The project was an ongoing collaboration between TERC and Bridge Multimedia. As a New York City-based content services company, Bridge Multimedia produces accessible media for television, the Web, and educational gaming technology. Offering their expertise at no cost to the project, they provided human voice narration of the text-based elements. They also connected the team to professionals with expertise in working with members of the target population. These individuals reviewed the materials and tested them in classroom settings. Additionally, Bridge Multimedia created a partnership with Slater Software. This allowed the team to explore the feasibility of using the picture icons and features available in their *Picture It* and *PixWriter* software to make Web-delivered text-based science content more accessible at no cost to the project. This software includes approximately 10,500 Literacy Support Pictures™ that can be integrated with text to assist with reading and comprehension and tools for delivery of the adapted material as PDF documents.

For the project, TERC was responsible for the design and development of the multimedia tool and related materials. They were also responsible for the collection, management, and analysis of data, for writing the final report of findings, and for identifying lines for subsequent research and development.

Research and Development Design and Related Findings

Design and development incorporated the six-step plan described in the next several pages. Pertinent research and related findings are incorporated into the descriptions.

Step 1. Identifying a Science Unit to Adapt into a Multimedia Literacy Tool

Prior to creating the tool, we selected a science unit for adaptation that met several criteria. It had to be Web-based; take only a few weeks to complete; include hands-on investigations and online inquiry; incorporate accurate, age-appropriate, standards-based science content; be written in age-appropriate linguistically accurate text, have a research base that indicated positive impact on the knowledge, science understanding, and interests of learners; and be free of copyright limitations. The EnViSci Network units — developed by TERC with funding from NSF (Award #9553592) — was selected as it met all of these criteria. From this series, we chose *Do We Throw Too Much Away?* as the unit to adapt. Besides meeting all of the criteria, it focuses on a concrete topic that is relevant to learners' everyday experience and allows them to collect data that requires only a small number of readily available tools.

Step 2. Adapting the *Do We Throw Too Much Away?* Web Site for Autistic Learners

The second step involved six major design tasks. The first task focused on adapting the content for use as a stand-alone unit that included the collection of classroom data and allowed for analyses that could be completed without sharing of data via a computer network. The resulting adapted unit was comprised of three sessions rather than the original six. Session 1 introduces students to the topic of trash—what it is, how it is produced, and how much Americans generate. Session 2 involves students in developing a plan to collect and sort all of the trash they generate in one school day into categories as defined by the EPA, executing the plan and collecting data, and analyzing their data. Session 3 involves students in figuring out how they can reduce the amount of trash they generate.

The second task involved becoming familiar with the *Picture It* and *PixWriter* software. To this end, team members attended a Webinar given by a representative from Slater Software. They then used their collective knowledge to brainstorm how to best integrate pictures into the unit so that it supports the three principles of Universal Design for Learning (UDL). The plan that emerged is described below.


Flexibility of representation to give learners various ways of acquiring information/knowledge would be achieved by presenting information in multiple ways as text, static images, narration, and multi-media (i.e. interactive Web content). *Multiple means of expression to provide learners alternatives for demonstrating what they know* would be achieved by providing a variety of activities that could also be used as assessments from which learners and/or their teachers could choose and do using accessibility software and methods they were comfortable using. *Multiple means of engagement to tap into learner interests, offer appropriate challenges, and increase motivation* would be achieved by offering users opportunities to work in ways that make sense and are interesting to them. They would be able to select stand alone and/or picture-assisted text; manipulate the size of images that illustrate key terms and concepts; listen to the text and simultaneously view highlighted words and/or text blocks; go back and forth to view text and images and narration as often as they would like.

At the recommendation of Bridge Multimedia, the team undertook a third task that involved leveling the existing text for Session 1. Bridge Multimedia funded this work, which was accomplished in conjunction with a specialist who had considerable experience in leveling science texts for materials published by a major publishing house.

The fourth task involved integrating features of *PictureIt* and *PixWriter* into the first Session of the unit. To accomplish this, we inserted images available from the *PictureIt* library to illustrate most of the key words on each page. Figure 1 is an example of a page from Session 1.



Figure 1: A Session 1 Page With Picture Icons

The fifth task involved integrating a text-to-speech feature using synthesized voice to “read” the text of each page. This feature gave students the opportunity to click a voice icon  and hear the text while seeing each word highlighted as it is read.

The sixth task involved using *PixWriter* to develop several Try This! activities that included a variety of pedagogical strategies students and/or teachers could choose from and use to do the unit and, at the same time, check their understanding, and demonstrate what they had learned. The Appendix includes examples of the Try This activities for Session 1.

Findings Associated With Completion of Step 2

- Web-based text could not be easily entered into the software so that pictures could be assigned to individual words. Specifically, each page of text had to be entered into *PictureIt* and then be coded for use with the site.
- The *PictureIt* software lacked icons for many of the terms requiring illustration.

- Selection of an appropriate picture icon had to be made from several pictures meant to illustrate the same term without any guidelines for making the selection.
- The pictures provided often failed to accurately convey the scientific content of a term.
- The static nature and size of the picture icons made it difficult to design crisp clear Web pages.
- A downloadable PDF version of the activities had to be created so that users who did not have the *PixWriter* software could use them.

These difficulties that emerged related to the use of *PictureIt* and *PixWriter* made us begin to question the use of the software as appropriate for our purposes.

Step 3. Submitting Session 1 to Experts for Review

Two individuals served as reviewers. One reviewer was the founder of Slater Software and the person with the most experience in the use of *PictureIt* and *PixWriter*. One reviewer had over 10 years of experience as a head teacher and supervisor of several special education classrooms with a focus on learners with autism. Both reviewers had a background in speech/language pathology and education.

To guide the review, we developed an instrument with specific questions to elicit feedback and suggestions that would be useful for revision of the session and provide direction for development of the remaining sessions. The instrument (included in the Appendix) listed questions for reviewers about the look and feel of the interface (font size, picture icons, text-to-speech feature), content and pedagogy (reading level, navigation, and strategies for classroom use), activities, and teacher materials. For the review, we sent reviewers the instrument and link to Session 1 and asked them to send us their feedback by the end of the following week. After reviewing their feedback, we set up follow up phone conferences to discuss the details of their responses.

Findings Associated With Completion of Step 3

- The leveled text was too simplistic (both reviewers).
- The speed of the synthesized voice narration of the text was acceptable (both reviewers). However, the intonation was unnatural. A human voice narration (either of a teacher or student) is preferable (one reviewer).
- Too many pictures were used to illustrate the text. Pictures are not needed for every word and create a page that is visually overwhelming. Pictures should be limited to those that support vocabulary associated with key concepts (both reviewers).
- Actual photographs are preferable to picture icons. Pictures are widely used in grade level science texts, convey what learners see around them, can be selected

to help learners accurately differentiate nuances, and are more scientifically accurate than the picture icons (one reviewer).

- Activity templates are very helpful and would make implementation of the unit and assessment of understanding easier for teachers (one reviewer).

Step 4. Redesigning Session 1

Our difficulties using *PictureIt* and *PixWriter* to adapt Web-based content and the limitations of the picture icons to accurately convey the scientific meaning of terms led us to dissolve our relationship with Slater Software. Redesign of Session 1 was accomplished as follows. Original texts were sent to the teacher/educator who had reviewed the previous version. She edited them to make them more appropriate for our audience and highlighted terms that required illustration. The revised text was posted on the site. Photographs were selected from those that we already owned, from those that we took for the unit, and from those available in the public domain. To make the interface less cluttered and increase effectiveness of the images, we included a reduced-sized image that appears above the term and a roll over feature that results in a larger version appearing in a box to the right of the text. The revised unit is available at <http://throwaway.test.terc.edu/> Figures 2 and 3 below and on the next page are examples of the revised interface.

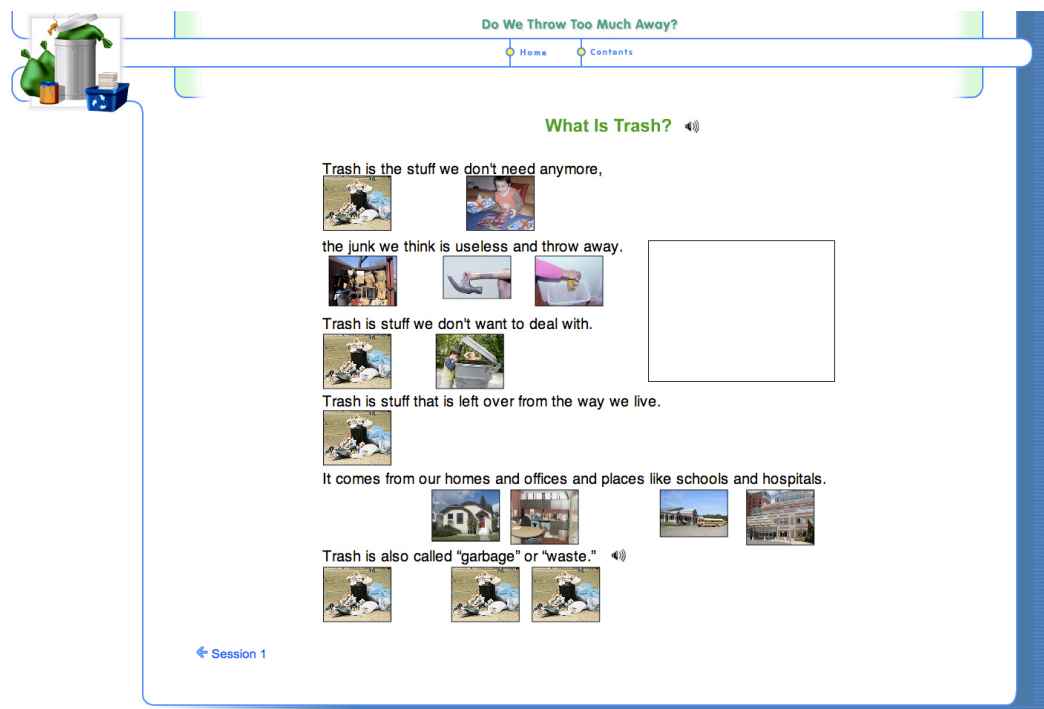


Figure 2: A Session 1 Page and Small Photographs



Figure 3: A Session 1 Page and Large Photograph

Step 5. Testing Session 1

The teacher/educator who had been working with us sent the link to Session 1 to one of the teachers that she supervises and asked her to do it with a couple of her students. Although the unit is being designed for higher functioning students (those close to grade level), those who used the session were earlier learners. Nonetheless, her feedback (summarized below) provided valuable insight into the redesign of Sessions 2 and 3.

Findings Associated With Completion of Step 5

- Are students able to read and understand the content of the session? *No—I think there is too much text for our students. It would probably work for students who are more truly close to grade level in terms of comprehension. Comprehension is such a big deficit even for my students who are relatively good at decoding. Some of the text is a little “wordy”.*
- Do students know what to do, what to click? Is navigation intuitive and easy? *Yes. I like how the image appears larger as you roll over it.*
- Do the images provided help students access the content of the unit? Are there any terms that need images or that have images and do not need them? *I might suggest more non-noun symbols. (Our teacher/educator clarified this to mean that multi-term phrases need to include multiple pictures rather than a single picture). I know that’s really tough to represent, but it’s a little hard to tell what the*

sections are about if you're just looking at the pictures. You see the objects/places/people but don't necessarily get a sense of what they're doing, where they're going (or where the trash is coming from, going to, etc.). Also, the pictures could be less complex. For example, I would gray out the other sections of the graph and just point to the one being discussed in the section with the circle graph. It would be easier to focus on the most important parts of the image.

- How helpful is the text-to-speech? *Very. I love the highlighting words as it reads.*
- Is anything confusing? *It would be good to have more space between lines, so it is clearer which pictures go with which text.*

Step 6. Completing the Unit and Testing with Students

Except for revision of the text, Session 1 is being adjusted to reflect findings from the review and adaptation of Sessions 2 and 3 is nearing completion. Also, under the leadership of Bridge Multimedia, human voice narration is being incorporated into the unit. To accomplish this text files were transmitted and reviewed to ensure that they were appropriate for narration. This review showed that some of the line breaks needed to be adjusted so that awkward pauses were not inserted at the end of lines of text. 8-12 year olds then auditioned as narrators. This resulted in the partners agreeing on a child to be the narrator. Recording of the narrations and their integration into the Web site followed.

It is important to mention that prior to creating the narration, TERC and Bridge Multimedia contacted experts in speech recognition software, language processing, and psychoacoustics as well as speech pathologists to identify clear speech methods to incorporate into the narrations to increase speech intelligibility for people—in both English and Spanish—with auditory impairments. The methods identified included adjusting the rate of words following each other; use of pauses within sentences and use of longer pauses than typical where there are commas and periods; attention to the articulation of sounds within words of longer duration; accuracy of word pronunciation; increasing “consonant power” of letters such as T, P, M, and N that are difficult to differentiate; attention to pitch contour and consistency of word intonation. Until now, clinicians have used these methods, but they have never been applied as an approach to recording human voice for audio books, instructional materials, dictionaries, etc. As such, the integration of this “intelligible speech” component into materials for the intended audience is in itself groundbreaking.

Following completion of the unit, it will be tested during the next phase of our out-of-budget funding with students functioning at the intended level and activities for implementation and assessment will be developed.

Appendix

Session 1 – *Try This!* Activities

***Try This!* Activity 1: What is garbage?**

- Activity Format: Thought sentences/prompts with fill in the blank answer sentences
- Instructions: For this activity students are asked to think about what they throw away at home and at school. Then, using the target word bank provided, they can “fill in the blanks” to describe what they throw away in these two places.

***Try This!* Activity 2: Where does garbage come from?**

- Activity Format: Fill-in-the blanks
- Instructions: For this activity students are asked to identify specific places in their home and at school where they throw things away. They use the target word bank provided to complete several sentences about where they throw things away.

***Try This!* Activity 3: How much garbage do we make?**

- Activity Format: Open Writing
- Instructions: For this activity students are given a target word bank of words to write about how much trash they think they generate at home and/or at school. You could provide students with one or more questions or topics to guide their writing. Some examples include:
 - Do you help take out the trash at home? If not, who does? Write about what you do with your trash and describe who picks it up, where it goes, etc.
 - How many bags of trash do you throw away every day, week, month?
 - Do you think that you throw away more trash at home or at school?

***Try This!* Activity 4: What is garbage made of**

- Activity Format: Open Response Questions
- Instructions: For this activity students are asked to answer two questions about which items they think they throw away most of – at home and at school. Students can use the words in the target word bank and add words of their own to construct answers to these two questions. Students should click on the blank provided after each question to answer each question.

Assessment

There are many ways these activities can be used to assess students’ understanding and monitor their learning as the progress through the unit.

- Review students’ answer choices or written work with them individually to point out areas where their ideas are expressed clearly and accurately, and identify other areas that might need improvement.
- Have a group or class discussion about students’ answer choices. This could help students learn from one another about what they throw away, or what their experiences are with trash collection and removal at home at home and at school – paying particular attention to identifying similarities and differences.
- Have students print and/or save their individual completed activities for you to review. You can then provide feedback and or give a “grade” or “score” as needed.

Questions for Reviewers

Interface

- Font Size
 - Is the text (font) large enough for most students to read, connect the text with the pictures, and connect to the spoken text?
- Pictures
 - Which pictures need to be substituted for ones that are more accurate or accepted?
 - What pictures might we use for the terms that do not have pictures?
 - How do we find pictures not included in the data bank to use for the unit?
- Text to speech feature
 - Is there a way to highlight text as it is spoken without going over to Flash?
 - Is the speed of the voiced text appropriate? If not, should it be slowed down or sped up?

Content/Pedagogy

- Reading level
 - Is the reading level appropriate for use with high functioning autistic learners?
 - Is the way the content is delivered easily accessible? Is it too advanced or not rigorous enough?
- Navigation
 - Will students be able to easily follow/navigate the links and pages?
- Internet and White Board Use
 - How comfortable are learners that might use the unit with the Internet and the use of White boards?
 - How comfortable are the teachers with having their students use the Internet and White boards?
 - Can/do students typically view sites on the web (example: Recycle City)?
 - Are students able to understand/access/make sense of content on the web even if it isn't picture assisted?
 - Is linking to websites that have not been adapted a good idea?

Activities

- Format
 - Which format for using *PixWriter* is best – fill in the blank, open space with word bank for writing/discussion, or should we use it to develop static/PDF activities that are done in print (i.e. circle or check answers)?
- PixWriter Challenges
 - *PixWriter* does not seem to support open-ended response question/discussion format also it is challenging to “format” what is there once it is written. What suggestions do you have for incorporating *PixWriter* activities into this session or the entire unit?

Teacher Materials

- What materials or information do you think teachers will need to support them in implementing/teaching this unit? Please place a check next to all that apply and feel free to add your own.
 - Pointers for using the unit with individual students and groups
 - Set up/questioning techniques
 - How to build on students' interests and what kids know
 - Glossary/Vocabulary building
 - Content-Concept building ideas
 - Pointers for having kids do the work and the teacher as guide
 - Building in rewards.
 - Setting up where the unit is headed (students collecting their own data/reducing amount of trash)