

# IMPROVING CONTENT AREA READING COMPREHENSION WITH 4-6<sup>TH</sup> GRADE SPANISH ELLS USING WEB-BASED STRUCTURE STRATEGY INSTRUCTION

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## ABSTRACT

Reading in the content areas of science, social studies, and current events is a difficult task that is even more elusive to Spanish speaking English language learners. There is a huge increase in children transitioning from their L1 (e.g., Spanish) to L2 (e.g., English) in classrooms across the US. These ELs face challenges due to a lack of fluency in decoding, vocabulary, and word, sentence, and discourse level complexities in English learning. Structure strategy instruction on the Web for English Language Learners (SWELL) is a web-based tutoring system that supports ELs in reading comprehension by teaching them about five text structures. In addition SWELL provides two adaptations for ELs – Spanish Scaffolding (where students were presented materials in both Spanish and English) and English Hybrid (where students were given the option of seeking assistance in Spanish by hovering over words, clicking on sentences, or viewing a full page in Spanish). In this paper we report on the design and pilot studies conducted within five classrooms at grades 4,5, and 6. Our results show improvements in reading comprehension measured by researcher design measures.

## KEYWORDS

Web-based intelligent tutoring, reading comprehension, computer based learning

## 1. INTRODUCTION

Reading in the content areas of science, social studies, and current events requires excellent decoding, vocabulary, oral language, and comprehension skills. Unfortunately most high-stakes assessments of reading comprehension show poor results for over 33% of children in grades 4 and 8. The numbers are even worse for Spanish-speaking Latino children who are most at risk for school failure. In 2008, the U.S. high school dropout rate for Latino adolescents was 22.5% compared with all other sub groups combined (Fry & Gonzalez, 2008). English language learners are at particular high risk for poor educational outcomes due to a myriad of factors including poorer reading performance (Proctor, Carlo, August, & Snow, 2005). They are most likely to drop out of school and have a lower high school graduation rate than any other group. Spanish speaking ELs also perform poorly on reading comprehension and mathematics standardized high stakes assessments like the National Assessment of Educational Progress (2013).

Researchers have suggested that improving vocabulary skills and knowledge of comprehension strategies can improve reading comprehension outcomes for ELs (Baker & Dalton, 2011; Proctor, Dalton, Grisham, 2007; Jimenez, 1997; Jimenez, Garcia, & Pearson, 1996; Proctor et al., 2005; Proctor et al., 2011).

The SWELL project is an outgrowth of a successful web-based intelligent tutoring for the structure strategy (ITSS) project where we developed and tested the system to teach 4<sup>th</sup> through 8<sup>th</sup> grade children the structure strategy. The system showed statistically significant differences favoring the ITSS groups in large scale randomized controlled trials in grades 4 – 8 (Wijekumar, Meyer, & Lei, 2012, 2013; Wijekumar & Meyer, 2012; Wijekumar et al., in press). The goal of the SWELL project was to extend the ITSS system by presenting two specific adaptations for Spanish speaking ELs – Spanish Scaffolding or English Hybrid.

We present our findings from the development and pilot studies here. Our findings support the growing research evidence base in support of the text structure strategy and web-based delivery of the instructional materials. Finally, this is the first development where the structure strategy has been used with Spanish speaking ELs in grades 4, 5, and 6 and showed promise in improving reading comprehension.

## 2. SWELL AND ITSS

SWELL (Structure strategy instruction on the Web for English Language Learners) is an extension of the ITSS system. An animated pedagogical agent named I.T. appears on the screen and presents modeling, practice, assessment, scaffolding, and feedback to learners. Each student is assigned a unique username and password which they use to log into SWELL and proceed at their own pace. Students learn how to find signaling words used by authors (e.g., in contrast) Figure 1, classify the text structure (e.g., comparison), summarize the text using a main idea pattern (e.g., dogs and cats were compared on friendliness, diet, and exercise patterns), and recall the text.

Instruction is presented about five text structures – comparison, problem and solution, cause and effect, sequence, and description. Text structures are presented in the sequence listed here. Approximately 12 lessons are available for each text structure. Lessons are presented from various domains (e.g., science text followed by sports). Passages are appropriate for each grade level learners.

The screenshot shows a web browser window titled "ITSS - Intelligent Tutor" with the URL "itss.psu.edu/IntelligentTutor/basemovie/basemovie.htm". The main content area is a lesson page titled "Two Very Different Dogs".

The text passage reads:

The Jello family has had two very different dogs, Wink and Dakota. Wink is the family's dog now and is a Jack Russell Terrier. Wink likes Mrs. Jello best. Wink likes to sleep on her lap. Wink growls when other family members try to pick him up from Mrs. Jello's lap.

Dakota, in contrast, was a mixed-breed dog that the Jello family had five years ago. Unlike Wink, Dakota never growled and liked everyone in the family the same.

Below the passage is a table titled "Important Table for the Comparison Structure":

Comparison Structure	Signaling Words used in Comparison Structure
Relates ideas on the basis of differences and similarities. The main idea is organized in parts that provide comparison between differences and similarities. For example: Comparing Killer whales and Blue whales on size, color, and life span.	instead; but; however; or; alternatively; whereas; on the other hand; while; compare; in comparison; in contrast; in opposition; not everyone; all but; have in common; similarities; share; resemble; the same as; just as; more than; longer than; less than; act like; look like; despite; although; just; options; difference; differentiate; different; ... (plus others you can find)...

Below the table, instructions read: "Drag this table to move it. Double Click this table to shrink it again."

On the right side of the interface, there is a "Log Out" button, a "Welcome Back Lori" message, and a list of four numbered blanks for finding signaling words:

- 1) \_\_\_\_\_
- 2) \_\_\_\_\_
- 3) \_\_\_\_\_
- 4) \_\_\_\_\_

Below the list, instructions read: "Click the signaling words in the passage and they will appear below."

The page footer indicates "Lesson 5 - Page 4/10".

Figure 1. SWELL Lesson to find signaling words

## 2.1 Theoretical Foundation of the Structure Strategy

The overall theoretical rationale for the development of SWELL shown in figure 1, rests on the cognitive schemas developed through the use of the structure strategy to improve reading comprehension (Meyer, 1975). During this training EL learners will learn how to identify the signaling words in the expository text (e.g., different, in contrast are signals for the comparison text structure), classify the signaling words into the text structure, write a main idea for that text structure (e.g., \_\_\_ and \_\_\_ were compared on \_\_\_\_, \_\_\_\_, and \_\_\_\_), and use both the main idea and the signaling words to write a full recall of the passage.

Creating memory representations of the texts using the text structure, aids in the strategic organization, associations, and ease of recall, resulting in improved reading comprehension. The quality of the memory representations are gauged based on student written protocols that are scored based on the use of top-level structure to organize recall, use of signaling words, quality of the expression of the main idea, and details remembered.

EL learners without the necessary prior knowledge and English language skills will require additional English language assistance in the form of contextual cues and vocabulary assistance in order to be able to receive the structure strategy instruction in a meaningful manner.

## 2.2 SWELL Adaptations for Spanish Speaking ELs

SWELL has seven unique features noteworthy for all learners but very relevant to the EL learners who are the focus of this project. These design features are part of the existing ITSS and are also used within SWELL.

First, SWELL narrates (with a human voice) all procedural information and instructions to the learner. SWELL also has narrations for the text passages and feedback given to the learner. Additionally, as I.T. reads a passage, the words blink on the screen allowing learners to follow the reading on the screen. This design mimics an adult reading to the child by pointing their finger on the words on the page as they read out aloud. This can assist EL learners who have difficulty processing the words. SWELL also has Spanish Language narrations for each procedure and passage. Animations are created to match the Spanish narrations. Lesson texts were carefully reviewed to meet the linguistic needs of ELs.

Second, the SWELL system progressively gives more detailed hints to the learner depending on how many tries they have completed for the practice assignment. For example, if the student is on their third try and they have not mastered the concept, I.T. presents a pop-up window on the screen with very detailed helpful hints and read the hints to the learner. The number of tries for each lesson and question vary from two to eight. This is designed to reduce any gaming related to tries. For example, when students realize that the system will give them more help after the second try, they tend to wait for the second try to get the correct answer. By varying the number of tries for each question, students cannot rely on a pattern to game the system.

Third, SWELL shows children how to use the structure strategy to read and comprehend texts in academic domains such as science, social studies, and current events. For example, in the first and second lesson students read a comparison text passage – differences between favorite Presidents – Lincoln and Washington. In the third lesson they read a science text comparing African and Asian Elephants. In the fourth lesson they read a passage comparing Olympic athletes, Dara Torres, Michelle Kwan, and Mary Lou Retton. This approach shows learners how the same text structures are applicable to all expository texts. To support the linguistic needs of ELs SWELL previews each lesson with vocabulary instruction and paraphrases of complex sentences.

Fourth, SWELL shows children how real-life texts are organized to promote transfer to environments where explicit signaling may not be readily available. This approach is part of the scaffolding process that allows gradual fading of supports as the student moves through the lessons.

Fifth, SWELL has alternative approaches to presenting information to the learners. For example, in the comparison of Olympic athletes, students click on a matrix showing how the each athlete is compared on the sport they played, the number gold medals won, and the year of their first Olympic win. In some cases a hierarchical diagram is shown to the learner focusing their attention to the logical organization of the text.

Sixth, SWELL shows learners how to combine text structure. For example, after completing about 10 lessons on the comparison text structure and another 10 lessons on the problem/solution text structure,

students are shown how they can combine comparison and problem/solution in one passage. Many real-life texts combine text structures and it is important that students learn how to read such texts for the structure strategy to be effective in improving their comprehension of academic texts.

Finally, SWELL allows the teacher to access all the students' responses at any time through a teacher viewing tool and provides bi-weekly reports to the teacher on student performance and gaming. The teacher can also modify the students' pathway through the lessons if they see that they are able to understand the content. For example, the teacher can take place the student in a more advanced lesson if they believe that the student has the background knowledge to understand the content.

SWELL Extension 1 – Spanish Scaffolding for each lesson .Students are provided narrated (and on-screen text) procedural information about each lesson in Spanish. E.g., for the earlier example on finding signaling words, "Cuandoyoleo el pasaje, buscolaspalabras de señalización. ¿Puedesver la palabra de señalización, diferentes en el pasaje?" After these instructions, students will read the passage in Spanish (with I.T. narrating the text in Spanish). Then I.T. gives the students a preview of what is expected in the English Language version of the lessons. The student is finally placed in the English lesson to apply the skills they learned in their L1. Figure 2 presents a lesson comparing two types of elephants with Spanish scaffolding.

The screenshot shows a web-based lesson interface. On the left, a text box titled "Elefantes" contains the following Spanish text:

Dos diferentes especies de elefantes existen hoy en día; estos dos tipos son el elefante africano y el elefante indio. Estas interesantes creaturas difieren dramáticamente en orejas, lomos y en que tanto viven. Los elefantes africanos tienen orejas muy grandes. Sus lomos se arquean hacia abajo a la mitad. Los elefantes africanos viven de 50 a 60 años.

Los elefantes indios tienen orejas pequeñas. Los lomos de los elefantes indios se arquean hacia arriba a la mitad. Ellos viven de 70 a 80 años.

Below the text is a photograph of an African elephant. A red arrow points to the elephant's ear, with the text "Pop-up Window" above it.

On the right side of the screen, there is a "Restart Page" button, a "Log Out" button, and a user profile for "Alex" with a "Hola Alex" greeting. A speech bubble next to the profile says "MIRE LA IMAGEN Y MIRE LAS OREJAS GRANDES". Below this, the instruction "Haga clic en las palabras claves:" is followed by a numbered list:

- 1.
- 2.

Figure 2. Spanish Scaffolding Lesson Screen

This adaptation is designed to take advantage of the Spanish literacy skills that students may have. It has been shown that L1 literacy skills transfer very well to L2 as noted by Cummins' dual language iceberg theory (Cummins, 1979). It has also been shown that tapping into their L1 literacy can aid their understanding of L2 – hence the Spanish version of the passage (Slavin & Cheung, 2003).

Two versions of the English language passage are available to the learners. The first form of the text is at grade level readability. The second is an easier version of the passage created using features identified by previous research studies (Abedi, 2006; Brown, 2007; Williams, et al., 2009). Students are initially placed into reading the easier versions of the English passage and gradually transitioned into the regular grade level lessons based on their scores in each lesson (e.g., if they are able to score 80% or higher on main idea tasks, they may be transitioned into the grade level passage in the next lesson).

SWELL Extension 2 – English Hybrid for each lesson: Each SWELL lesson has an English preview lesson for the EL learners. Examples of elements covered in this preview are: vocabulary enhancements (activities designed to identify cognates, roots, affixes, and morphological relationships; using words in context, and learning synonyms) and previewing sentences in easier versions. In these adaptations students can also click on specific words on the screen and hear the word meaning in English. Students may highlight a whole sentence and have I.T. give them an alternative simplified sentence to help them understand it. The vocabulary enhancements will use current research by Proctor et al., Dalton et al., Kamil & Herbert, 2005, and Beck, McKeown, & Kucan, 2008.

After completing these previews of the lesson, the student is allowed to complete the full lesson by clicking on signaling words, writing a main idea, and writing a full recall of the passage.

This adaptation is designed specifically for learners who do not have the Spanish literacy or oral language proficiency necessary to first practice in their L1. Instead we are trying to give them scaffolds to develop their English language vocabulary and background knowledge necessary to comprehend the grade level texts. Again, students initially read the easier version of the English passage prepared for the Spanish Scaffolding enhancement. As they gain confidence and their performance meets the thresholds set after the iterative studies, they are transitioned into grade level text passages.

### **3. RESULTS FROM PILOT STUDIES**

The research team has recently completed three series of quasi experimental research studies on the SWELL software with children in grades 4,5, and 6. Our findings on a single subject design study showed children using the SWELL software made expected progress in the signaling word, text structure classification, main idea, and recall tasks. Usability tests showed that children using the English Hybrid version of SWELL were unable to navigate the system without explicit instructions in Spanish. In addition, the usability studies also showed that most children in Southern Texas did not understand the accent of the narrator who was from a different part of the country but spoke Spanish. The team revised all the narrations using a local speaker to ensure that all children in the area would understand the narrations. Finally, the extended study with a matched control group showed that the SWELL classroom children outperformed the matched sample on signaling word and main idea tasks.

### **4. CONCLUSION**

Based on the iterative design experiments conducted during years 1 and 2 we have made adjustments to the SWELL lessons, sequences, and types of support for the children. This research is the precursor to a full year randomized pilot study planned for this academic year. The preliminary research showed positive outcomes. The year 3 studies are under way and pre-testing has been completed. Students have started using the SWELL software in the classrooms and teachers are reporting that students are learning well.

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