Beyond the Keyboard: Implementing Speech Recognition Technology for Writing Through a UDL Approach

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Abstract

Universal Design for Learning (UDL) is a pedagogical framework that serves as a lens to view how technology can be used to address learner variability. It creates a compelling context for teachers to integrate technology into their lessons to reduce barriers that arise from the learner's interaction with the curriculum or environment. This paper provides some general recommendations based on a case-study of three teachers who partnered with a technology integration specialist to use the UDL Design Cycle to make decisions about addressing learner variability and integrating Speech Recognition Technology (SR) into the writing curriculum.

Implications for teacher implementation of technology through a UDL approach are discussed. This paper also describes how UDL case-study research was conducted in conjunction with the UDL Reporting Criteria (UDL RC), a set of guidelines for researchers and practitioners who are designing and reporting on UDL implementation.

Keywords

UDL Research, Technology Integration, Speech Recognition, Speech to Text, Implementation

INTRODUCTION

Speech Recognition (SR) is a powerful feature built into the operating systems of modern phones, tablets, and computers. It enables a person to control their device with their voice rather than via the keyboard (Shadiev, Hwang, Chen, & Yueh-Min, 2014). This technology has evolved rapidly in the last few years to include a more refined user interface with improved predictive capabilities, faster transcription speed, decreased recognition error rates, and a reduced user learning curve (Huang, Baker, & Reddy, 2014). The advancement of SR's capabilities has enabled young students to more effectively use this tool in educational settings (Haug & Klein, 2018).

In can be groundbreaking for students to possess new ways of composing text beyond the use of a pen or keyboard. The way a student goes about completing a writing task can greatly impact their success. By applying approaches that more closely align with their strengths and skills, a student is more likely to perform well. Students with strong verbal expression skills may be able to transfer this ability to the skill of composing text using SR.

BACKGROUND

Traditionally, writing has been challenging for many students. The National Assessment of Educational Progress (NAEP), known as "the nation's report card", asserted that roughly 75% of 8th and 12th graders were not proficient in writing during its most recent national writing assessment (National Center for Education Statistics, 2012). Studies of writing instruction in elementary, middle and high schools indicate that not much time is spent teaching writing, students are not engaged in academic writing, and are frequently not using computers to write (Applebee, 2011; Brindle, Graham, Harris, & Hebert, 2016; Gilbert & Graham, 2010). These findings are surprising, since technology has been shown to expand one's cognitive capabilities time and time again (Prensky, 2013). Just as the calculator enhances one's computational ability, and apps like Google Maps enhance one's ability to navigate unfamiliar places, SR can expand one's ability to compose text.

A recent literature review of SR use in schools found that it can improve the fluency and quality of student writing, especially for those who struggle with mechanics and content generation (Pennington, 2018). Other studies show additional benefits for student writers, such as increased student confidence (Toll, 2014), and increased motivation to write (Hwang, Shadiev, Kuo, & Chen, 2012; Hwang et al., 2012). The benefits of SR are amplified by its connection with other digital writing spaces such as text-to-speech (TTS), enabling writers to easily listen to what they have composed, and check their grammar. These features allow writers to apply context-specific corrections to ensure the structural integrity of their compositions.

Although the benefits are promising, SR's effectiveness may vary according to several factors. These include students' personal characteristics and writing ability. For example, those with frequent spelling errors in their writing may register substantial gains when compared to students who are good spellers (Pennington, 2018). Other factors that influence the effective use of SR may include individual student preference, learning context, and the

type of writing task (Holmes & Silvestri, 2012). For instance, a particular student may benefit more from using SR to brainstorm ideas or create an outline for an essay, than using it to compose the essay itself. UDL can serve as a lens for examining the variables affecting effective SR use. By considering the principles of representation, expression and engagement, teachers can learn more about student preferences, strengths and the supports they require to be successful. Teachers can use the UDL guidelines to outlay various approaches for students to help them discover how they can most benefit from this technology (Rao, Currie-Rubin, & Logli, 2016).

By implementing SR as part of UDL infused writing lessons, teachers can better understand how technology can support writing instruction and literacy learning. Research on SR for writing has focused on investigating how the technology can serve as an assistive tool for students labeled as having learning disabilities. Little research exists on using SR as a feature of everyday digital writing spaces in regular, inclusive classrooms (Pennington, 2018). Application of the UDL framework in mainstream classes provides all students with access to tools and that support and extend their learning.

THE UDL DESIGN CYCLE

There are several resources that teachers can use for UDL-based lesson planning such as the six guidelines proposed by Dymond and her colleagues (2006) or the Innovation Configuration matrix developed by Israel, Ribuffo, & Smith (2014). The teachers in our study used UDL Design Cycle by Rao & Meo (Rao & Meo, 2016), a concrete, iterative six-step approach to lesson planning. The UDL Design Cycle is an effective planning tool for teachers who are new to UDL, because of its a simple, intuitive, step-by-step process. The UDL Design Cycle consists of six steps: (1) Identify the challenges, preferences, and needs of learners in relation to the skills and content they are required to learn (2) Establish clear learning goals for the students (3) Design flexible assessments in relation to each goal (4) Consider the strategies and tools to incorporate into the lesson (5) implement the lesson and (6) Reflect and revise.

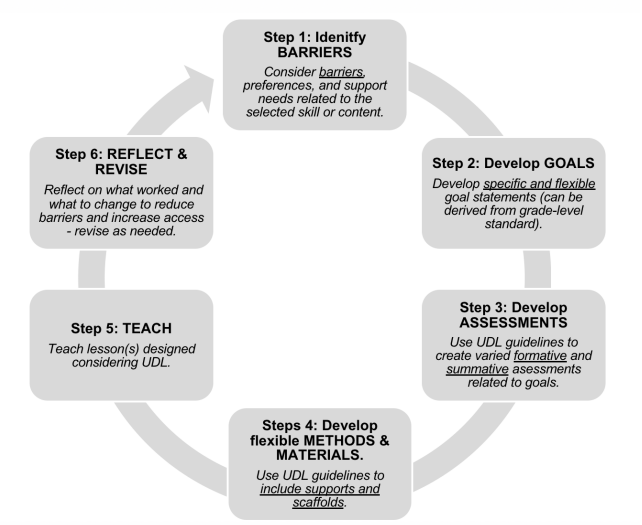

Figure 1. The UDL Design Cycle (Rao & Meo, 2016)

Reprinted from "Universal Design for Learning to Design Standards-Based Lessons," by Rao & Meo, 2016, *SAGE Open*, *6*(4), 2158244016680688. Reprinted with permission.

This paper describes general strategies for using The UDL Design Cycle, based on a case-study at a school that serves students with language-based learning differences. The researcher, who worked as the schools' technology integration specialist, provided individualized peer coaching with the UDL Design Cycle for three teachers of different grade levels (grade 4, grade 6 and grade 8). The teachers already had a foundational knowledge of UDL due to their school's UDL-based instructional approach. Lessons were focused on encouraging students to apply their strengths and preferences to overcome potential challenges to learning.

The teachers and the specialist worked together to create a UDL-based instructional unit composed of five lessons centered on the five stages of the writing process (pre-writing, drafting, revising, editing, and publishing). The duration of each lesson was one week, spanning a period of five weeks.

The instructional units varied by content area and skill-level objectives since the teachers taught different grade levels. However, all lessons were structured to use the features of digital writing environments to support students. Week long lessons allowed teachers to create opportunities for students to practice the use SR in different contexts, while offering opportunities for practice and individualized attention for students who needed it.

In the first step of the design cycle, teachers should address the challenges, preferences, and needs of learners in their class. In this study, learning profiles were created for each student. Student profiles include test scores for reading comprehension, spelling, writing and verbal proficiency.

Profiles also contain narratives describing the student's personal characteristics, interests, work habits, and suggested accommodations. Since student profiles accrue yearly, samples of student work and recommendations from previous teachers are also included. Student profiles are a useful tool for finding out the degree of learner variability in the classroom. If such profiles are not available, parents and previous teachers can be surveyed, and student test scores obtained.

In steps two and three of the design cycle, teachers should access their grade-level curriculum and set goals for the unit. The goals in this study focused on writing skill development and content knowledge acquisition. Teachers should create formative assessments and a summative assessment aligned with stages of the writing process, in order to measure progress. The topics of the writing assessments should be flexible and geared towards subjects related to student background knowledge and personal interests. Prior to assessment, teachers can help students create personalized lists of topics from which to choose. Teachers can gauge student writing progress, and provide reinforcement if necessary.

The fourth step of the design cycle, Methods and Materials, is usually the most involved and time-consuming. Teachers should create a series of charts of supports that can help students master the assessments and achieve the identified goals. Supports may include resources, tools, and techniques. Teachers should access the UDL Checkpoints for insight into the types of supports needed. Supports should focus on areas such as increasing engagement, supporting executive function, and providing quality feedback.

Teachers should structure UDL lessons into three parts. (1) An introduction will provide a clear purpose for the lesson, and activate background knowledge on the tools and techniques being used, and content connections to student experience. The introduction is designed to show students the relevance and value of the lesson. It might include a video or short slideshow of engaging pictures pertaining to the content and the tools and technologies being used on that day. Teachers should highlight key vocabulary words and prompt students to talk to their peers, and make connections to personal experience and prior knowledge. (2) Strategy instruction can be used to break down the process of learning how to use tools and techniques into graduated levels of practice. These include (a) develop background knowledge of the strategy (b) discuss the strategy (c) model the strategy (d) guide the use of the strategy (e) support independent practice. Teachers can use short, authentic writing tasks during guided and individual practice to increase student engagement. These writing tasks might include observations of the physical world, emails to teachers or friends, and commenting on blog posts. (3) A formative or summative assessment should be included to measure progress toward the goals. This assessment should resemble the individual practice activity that students completed in the last part of their strategy instruction.

In our study, although students were provided strategy instruction on SR use, and asked to use for short writing tasks, they were not required to use SR as part of their writing assessments. This approach should be considered for teachers integrating any type of technology. A primary goal of UDL is to intentionally build options and flexibility into lessons so that students can approach learning in ways that align with their strengths. In this spirit, teachers should design lessons so that students are encouraged to use apps and integrated digital tools that most align with their strengths and preferences; tools that feel right for them. Allowing students to apply their strengths and preferences leads to feelings of confidence and sense of self-efficacy (He, 2014) and increased motivation (Hwang et al., 2012; Shadiev et al., 2014).

At the fifth step of the design cycle, the teachers should implement their carefully designed UDL infused lessons. In this study, the specialist observed each lesson, providing technology support and modeling technology use. He observed and recorded successes, challenges, and any other significant occurrences. It is recommended that an outside observer provide feedback to teachers, if possible.

In the sixth and final step, teachers should reflect on the previous week's lesson plans and modify their current lesson plans based on the data. Issues and challenges should be addressed in subsequent lessons. The team should share their observations and discuss lesson strengths and weaknesses. This step is often enjoyable due to the candid and collaborative nature it encourages. Having an outside perspective on what is happening during the lesson can be an effective way of improving instruction, noting "things that went well" "things that were challenging" and "unexpected outcomes".

THE UDL REPORTING CRITERIA

The study described by the paper was conducted in conjunction with The UDL Reporting Criteria. The tool functioned as an organized checklist for the researcher to identify the key elements of the UDL implementation and how these elements should be described in the paper. Using the tool boosted the researcher's confidence in his comprehensiveness and depth of the UDL strategies being described.

A researcher deliberately documenting the process using the UDL Design Cycle will satisfy nearly all the criteria included in The UDL Reporting Criteria. There is significant overlap between these tools. As such, they work hand in hand, benefiting any researcher conducting a study that involves integrating UDL into classroom practice.

CONCLUSION

The UDL Design Cycle served as a powerful instructional design tool for integrating SR and other technology tools into writing instruction. It can help teachers gain a more in-depth understanding of their students and become better prepared to teach them. The use of The UDL Design Cycle allows teachers to quickly assess student knowledge, identify who needs additional support, and who needs more time. Overall, it can make teachers feel more organized and prepared for instruction.

The iterative, reflective nature of the UDL Design Cycle can be used to encouraged collaboration between teachers and other faculty members such as technology integration specialists or learning specialists. Having face to face time with colleagues to discuss students, and design lessons based on a concrete approach such as the UDL Design Cycle, is a clear and effective way to integrate UDL into instruction.

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