

Tech-Based Approaches To Supporting And Engaging Diverse Learners: Visual Strategies For Success

Sarah E. Bryans-Bongey, Nevada State College, USA

ABSTRACT

This paper explores teaching and learning applications at the intersection between Universal Design for Learning, Assistive Technology, and mainstream educational technology. Informed by the SETT framework in which the technology choice is informed by student, environment, and task (Dell, Newton, & Petroff, 2017; Zabala, 2005), this paper is designed for a learner-profile consistent with learners who need concrete and visual approaches to optimize receptive and expressive communication. The visual and interactive approaches shared here include Universal Design, graphic organizers, and comic strip creations, and may appeal to teachers of students on the autism spectrum as well as others who are responsive to visual supports.

While it is not possible to predict the exact nature of the environment and tasks at hand for these students, the paper leaves those decisions in the hands of the readers. Approaches and suggestions shared here reflect practitioner experience, findings from the literature, and data from a 2016 course, in which a small number of diverse students reinforced the concept that UDL approaches increased their engagement and success.

Keywords: UDL; Diverse; Teaching; Technology; Visual-Learners

Assistive technology (AT) is increasingly evolving in concert with its more mainstream counterpart, educational technology. Although initially dedicated devices, DynaVox, GoTalk Now, Proloquo, Co-Writer, and others have recently developed products and applications optimized for iPads, Smart phones, Chrome books and other mobile and mainstream devices. Many such applications and devices successfully use visual approaches to augment teaching, learning, and communication. Similarly, vendors and educators who developed visual applications for general use, have found their products and approaches to be popular among teachers and learners with special needs (Culbert, Flood, Windler & Work, 1998).

This paper explores applications at the intersection between Universal Design for Learning, Assistive Technology, and mainstream educational technology. Technology use considers the SETT framework developed by Zabala in 1995, in which the student, environment, and task drive the selection of technology (Dell et al. 2017), this paper emphasizes approaches that specifically support visual learners. This paper merges discoveries from a 2017 CSUN Assistive Technology Applications certification program with data and observations from a 2016 course in which diverse students reported on the rival merits of various instructional approaches to increase student success.

LITERATURE REVIEW

According to the 2010 U.S. Census, 53.9 million school-aged children (age 5-17) live in the United States. Of those children, 2.8 million (5.2%) were reported to have a disability. The figures below demonstrate that a large proportion experience cognitive difficulties (Figure 1). With few exceptions – states enroll 85% or more of these children in public schools (Figure 2).

Figure 1. Disability status and type for school-aged children inside and outside metro areas in the United States: 2010

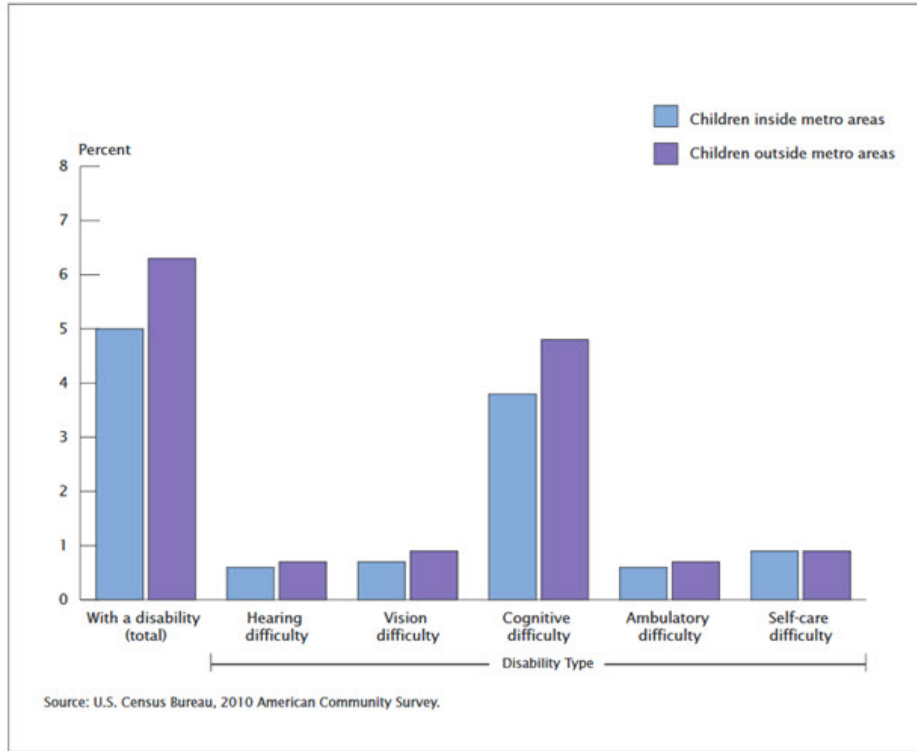
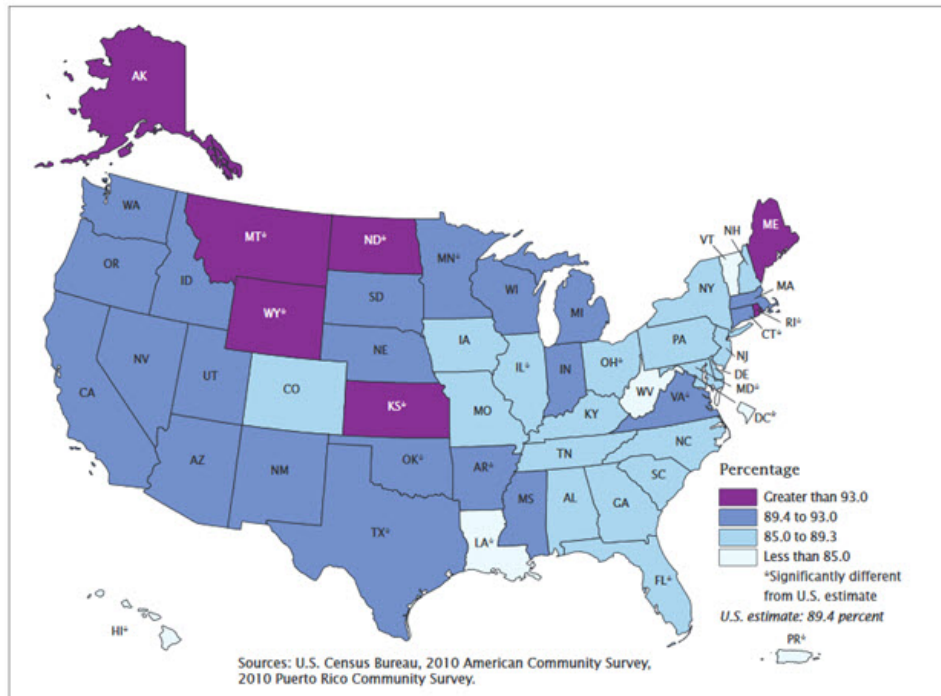


Figure 2. Percentage of school-aged children with disabilities who were living in metro areas and enrolled in public schools



Diverse learners in schools include people with wide-ranging strengths and challenges in the areas of cognitive, sensory, motor, and social-emotional comprehension. With access to content viewed as a continuum, other factors not considered in the realm of disability also impact cognition and learning. For example, language learners who are trying to grasp content in a non-native language may have challenges. The emphasis of this paper is on supports that supplement linguistic and text-based content. The three approaches suggested here have been endorsed in the literature. They include: (1) Universal Design for Learning (Rose & Meyer, 2002); (2) graphic organizers (Singleton & Filce, 2015), and (3) comic creation (Suwastomo, 2016).

Universal Design for Learning (UDL) emphasizes the provision of multiple means of engagement, representation, and action and expression (Center for Applied Special Technology, 2017; Rose & Meyer, 2002) with findings that indicate this general approach supports a wide range of learners and can significantly reduce barriers for learners with special needs. “In practice, universal design and AT often work in concert to achieve optimal and practical results” (Hitchcock & Stahl, 2003). This “modern era of assistive technology coincides with the technology revolution that began with the first computers” (Edyburn, 2015, p. 1).

PURPOSE OF THE STUDY

As these forces converge – Assistive Technology and Instructional Technology, universal design approaches, and inclusion of diverse learners in the mainstream classroom – the goal of this paper is to describe and explore uses of three technology-based approaches that offer support for a wide range of learners, particularly those with autism and those for whom English is a second language.

METHODS

The application and use of the three visual approaches described involves observations based on the author’s own role as instructor of educational technology and autism courses taught at Nevada State College from 2014 to 2017. Also included is survey data collected in the context of a teacher preparation class held at Dooley Elementary School in Henderson, Nevada. The course was supplemented with extensive online content and pre-service teachers learned strategies for incorporating technology into the teaching and learning process. The students are representative of a highly diverse population in which over 50% of students are Hispanic, Asian, or African American.

Graphic organizers and comic strip creation tools can be said to meet the criteria for Assistive Technology devices. However, a teacher’s construction of UDL approaches to instructional design and teaching seems to be more in keeping with the definition of an Assistive Technology service. This interpretation is based on Public Law, 100-407, the Technology-related Assistance to Individuals with Disabilities Act of 1988 and amendments (Center on Disabilities, CSUN, 2013).

The three educational or AT tools and services explored in this paper will begin with a discussion of Universal Design for Learning, followed by graphic organizers and comic strip creations.

Universal Design for Learning

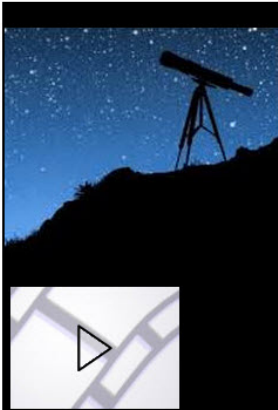
Students of EDUC 409 (Technology Applications in Education) were provided with the visual support of a UDL-designed course to support, enrich, and extend their face-to-face learning experiences. Previous studies have shown an LMS such as Moodle, Blackboard, or Canvas, can be successfully used to provide students with UDL benefits (Bryans-Bongey, Hughes & Scherer, 2012). In keeping with this strategy, the course described in this paper (and the associated LMS site in Canvas) was designed to use varied design approaches consistent with UDL. Each module included an overview, list of learning objectives and activities, course content, and an activity checklist. The module organization may be seen in Figure 3 below.

Figure 3. Online modules were designed in a consistent and predictable manner

Module 2: 9/8-9/20			
Module 2 Overview			✓ ⚙
Module 2: Learning Objectives and Activities			✓ ⚙
Discussion: Communicating Goals, Tracking Student...	Sep 13	20 pts	✓ ⚙
Observation Reflection Form - 9/10	Sep 13	10 pts	✓ ⚙
Dooley Session-9/10 (for timeliness and participation)	Sep 10	10 pts	✓ ⚙
Observation Reflection Form - 9/17	Sep 20	10 pts	✓ ⚙
Dooley Session-9/17 (for timeliness and participation)	Sep 17	10 pts	✓ ⚙
Backwards Lesson Plan	Sep 20	25 pts	✓ ⚙
Activity Checklist for Module 2			✓ ⚙
Module 3: 9/21-10/4			
Module 3: Overview			✓ ⚙
Module 3: Learning Objectives and Activities			✓ ⚙
Discussion: Establishing Classroom Rules and Proce...		20 pts	✓ ⚙
Dooley Session-9/24 (for timeliness and participation)	Sep 24	10 pts	✓ ⚙
Observation Reflection - 9/24	Sep 27	10 pts	✓ ⚙
Dream Classroom Floorplan Assignment	Oct 4	25 pts	✓ ⚙
Activity Checklist for Module 3			✓ ⚙

Figure 4. Module 2 Overview

Module 2 Overview



Welcome to Module 2 of *Technology Applications in Education!*

Over this second two-week module, we can start to get into the essence of the class. We are off to a solid and promising start to the semester. All of you have completed your first observation of a technology-rich classroom and learning activity. You should also now have a copy of the course textbook. This week's assigned reading of Chapter 2 will inform your in-class observation, and will allow you to consider and explore research-based approaches involving the use of technology to establish/communicate learning goals, track student progress, and celebrate success.

We will be weaving in a standard discussion assignment that will span the two-week module and allow you to connect theory with practice.

You will be challenged to draw from your prior knowledge, course content, and your in-class observations as you complete a "Backwards Lesson Plan" that describes learning objectives, strategies, application, and assessments associated with one or more learning activity you observed in an actual classroom taught by another teacher.


This should be a thought-provoking and engaging two weeks! As always, please [contact me via email if you have questions or comments](#). I noticed that some of you did not complete your observation reflection form. Please contact me if you have questions on that because these will be a standard assignment and you will not want to lose those points. Thanks, and see you in Room 33 on Thursday at 9:30! :)

Click the arrow if you'd like to hear the audio overview for Module 2.

While the overview sought to provide students with an orientation to the current content, it also provided resources for follow-up and outreach. The learning objectives shown in Figure 5, promote student time on task and an accessible way to identify needs and stay accountable.

Figure 5. Learning Objectives and Activities

Module 2: Learning Objectives and Activities



Course-Level Outcomes:

- Determine the purpose and impact of using technology in the classroom.
- Study best practices that change the way educators teach and students learn.
- Integrate technology tools into daily instruction.

Objectives: By the end of this module, students will:

- Demonstrate an understanding of key instructional design approaches and technology-rich strategies for implementing them.
- Observe, identify and describe a best practice use of educational technology.
- Reflect upon strategies you've read about and observed
- Develop and share one creative strategy using technology to communicate learning goals, monitor student progress, and/or celebrate success.

Week 2 and 3 Activities


- **Read Chapter 2 (p. 27-37) of *Enhancing the Art and Science of Teaching with Technology*.** The chapter focuses on theoretical and practical aspects using technology to communicate, track, and celebrate student learning.
- **Contribute to In-Class Discussions and Complete Weekly Observation Forms**
- **Participate in a timely and active manner during weekly observation sessions.**
- **Respond to the Discussion Assignment (Initial post due Sunday, 9/13. Responses to others due Sunday, 9/20).**
- **Complete the Assignment** - Based on an observed classroom use of technology, create and submit your Backwards Lesson Plan (due Sunday, 9/20).

Advantages of this web enhanced and universal design approach to a primarily face-to-face class include the ability for students to access content before and after the associated class sessions. Interactive content can be posted, played, revisited, and replayed. The objectives and overview provided a cognitive map and also provided practical guidance as to days, dates, and events. All materials, ranging from the syllabus to course content, were posted in the online site. As shown in Figure 6, students were able to check up on their progress through the provision of an “Activity Checklist” for each module.

Figure 6. Activity Checklist

Activity Checklist for Module 2

Did You?...



- **Read Chapter 2 (p. 27-37) of *Enhancing the Art and Science of Teaching with Technology*.** The chapter focuses on theoretical and practical aspects using technology to communicate, track, and celebrate student learning.
- **Contribute to In-Class Discussions and Complete Weekly Observation Forms (2 for this module)**
- **Participate in a timely and active manner during weekly observation sessions**
- **Respond to the Discussion Assignment**
- **Complete the Assignment** - Based on an observed classroom use of technology, create and submit your Backwards Lesson Plan.

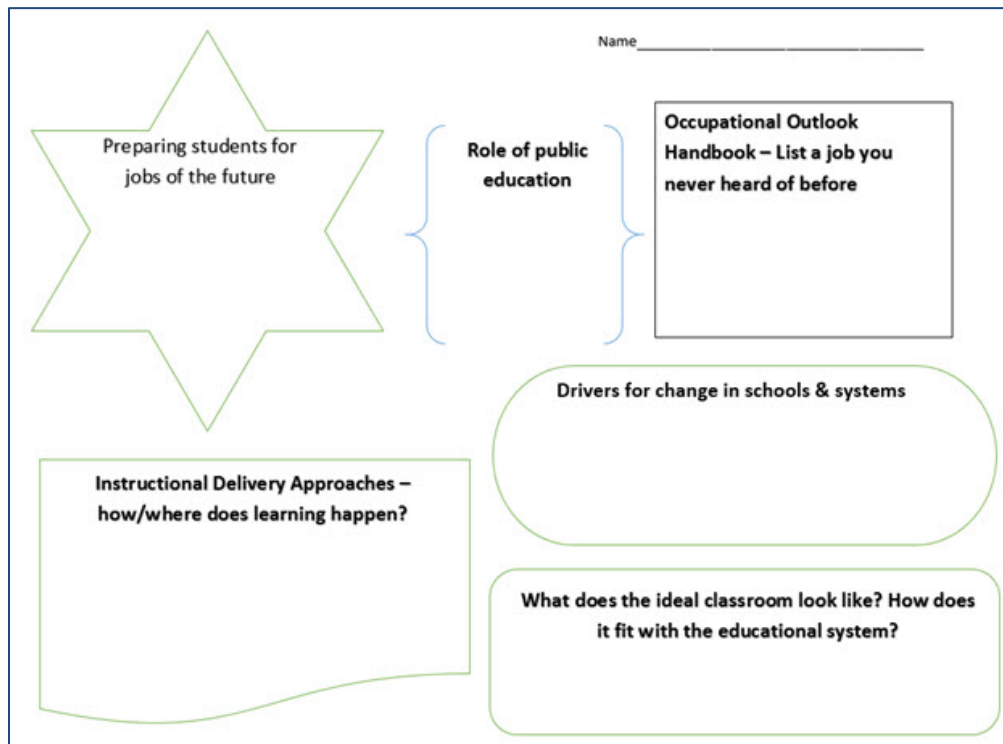
Grading rubrics for each assignment, as well as checklists, peer review opportunities, and assignments with iterative stages (involving feedback from the instructor) provided additional supports. In the area of content, every effort was made to select multiple means through which to represent information, for example, video, audio, text and interaction/discussion were frequently used in combination when presenting the same content. Student engagement was also promoted and students had frequent opportunities to choose from two or three assignment or project options.

Graphic Organizers

Graphic organizers enable the teacher and the learner to highlight ideas and relationships in a visual and constructivist manner. There are many uses and types of graphic organizers, and they can be easily created by the teacher to support discussion, planning, and independent/individual success as shown in the organizer in Figure 7 which was assigned after reading and presentation, but before the individual broke out into discussion groups and the preparation of a script for a talking avatar to describe “Schools of the Future”.

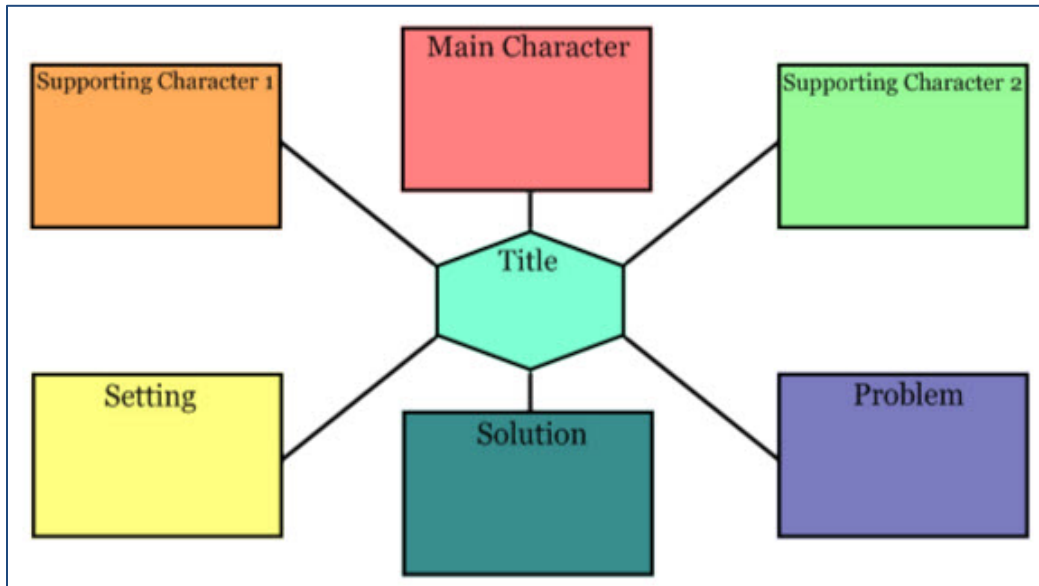
In a study endorsed by the U.S. Department of Education, it was shown that graphic organizers promote student comprehension of complex and expository text and concepts. The study included 107 special education and general education teachers working at the K-8 level and found that 90.2% of respondents found their instruction was improved through the use of graphic organizers (Culbert, et al. 1998).

Figure 7. Graphic organizer used for independent processing after an in-class presentation/research-session and before a discussion/activity.



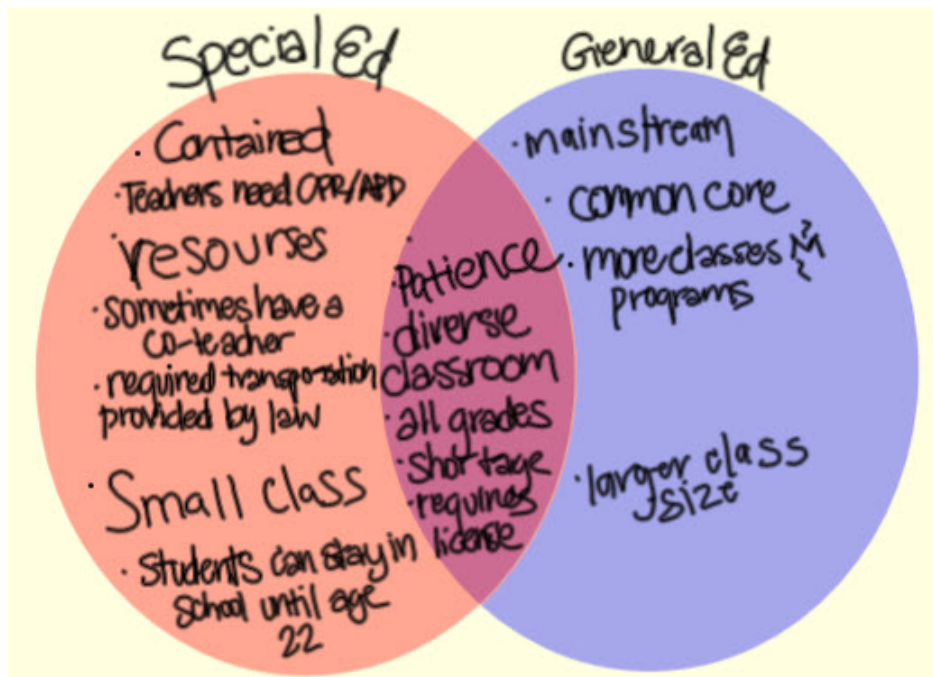
Teachers frequently use graphic organizers because they compress and focus information and show the “interrelationships among parts as well as the relationship of the parts to the whole... They help students view information on both holistic and detailed levels” (Barkley, Major & Cross, 2014, p. 261). Figure 8 below shows a graphic organizer used to map the parts of a story.

Figure 8. This graphic organizer is designed to map parts of a story. For younger grades, this design may be simplified. Pictures may also be added to provide further visual guidance.



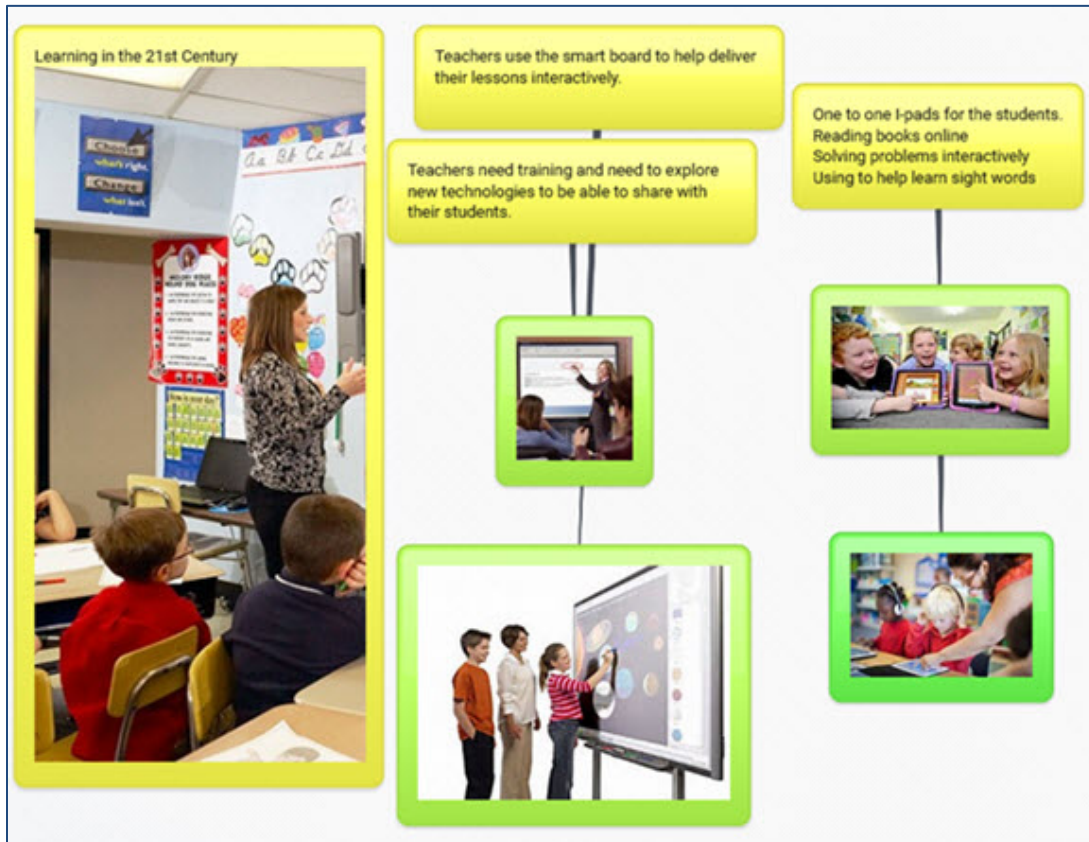
In the classroom, graphic organizers guide students to specific or critical questions they need to address, thus helping them organize their thinking and construct solutions and hypotheses. Graphic organizers also support collaboration in settings involving large-group participation such as in the use of a SMART Board activity shown in Figure 9.

Figure 9. This Venn diagram represents a SMART Board activity in which students contributed ideas to the question of similarities and differences between special education and general education classrooms.



In addition to the above-mentioned applications, these visual devices may be used by teachers or learners to organize or express concepts in a summative way. Figure 10 below shows part of a graphic organizer that was used by a pre-service teacher to describe interrelationships between teaching, literacy, and technology in the 21st century.

Figure 10. Graphic organizer created by student as part of an assignment to generate a visual overview on the topic of technology and literacy.



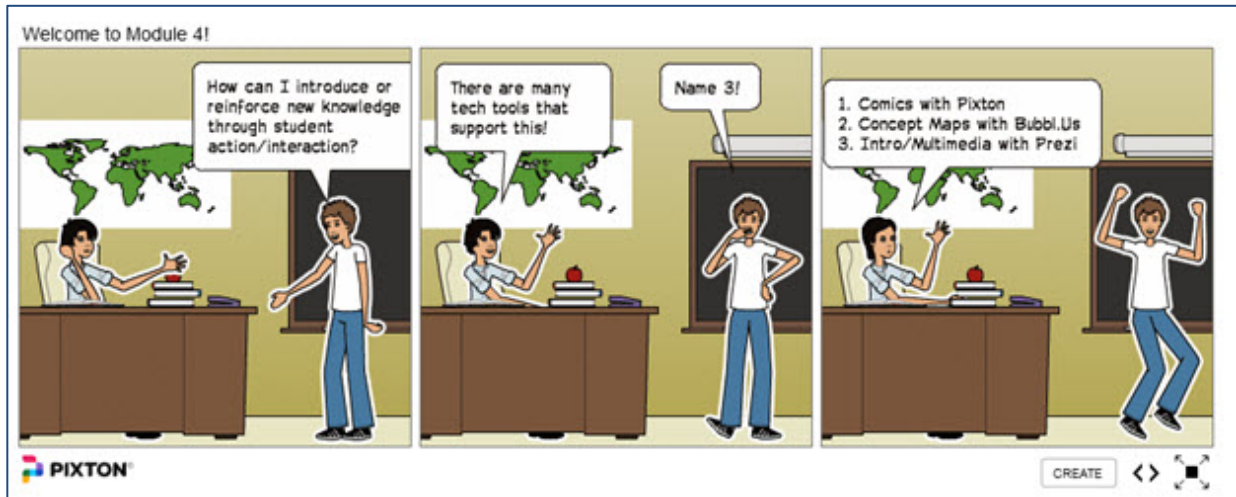
Comic Strip Creation Tools or Story Boards

Comic Strips and story boards are also visual options to support student engagement and constructivist approaches with great value for students with special needs or those who benefit from highly visual strategies. These can be simple, paper-based journals or story board frame-printouts, with varying levels of labeling or captions. In the online realm there are many digital tools that allow the user to create professional looking comics and storylines. The comics can be used to promote positive behavioral goals, as described by Carol Gray and her use of comic strip conversations (Glaeser, Pierson & Fritschmann, 2003). Comic strips can have relevance for special educators as well as teachers supporting diverse learners in the general education setting.

Comic strips and story boards can also be used to express content knowledge. Teachers can establish assignments in which students are asked to use free online tools such as *Pixton*, *Creately*, or *Storyboard That* to express their own learning or creative ideas. At the college level, students who were asked to create a comic as an assignment universally agreed that the creation of comic strips helped make content both enjoyable and interesting.

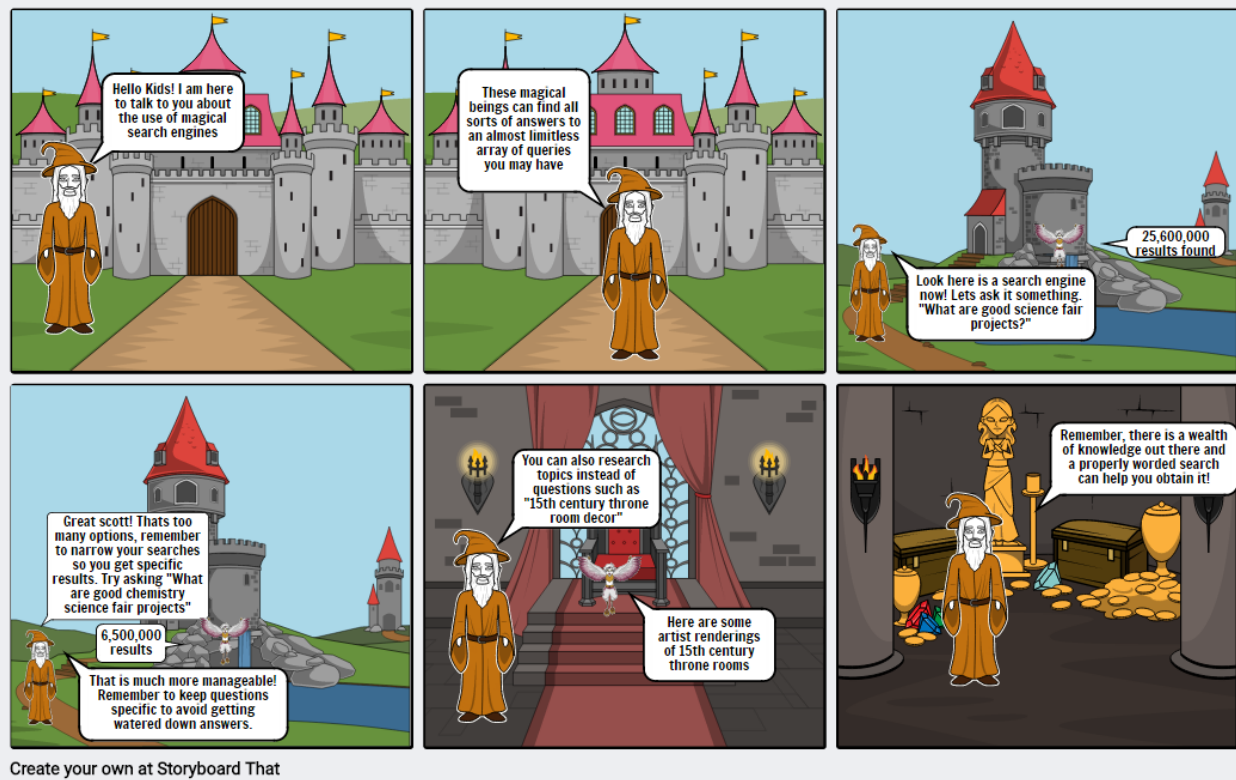
As seen in Figure 11, teachers can also use them to introduce new content in a visual way or they can assign a storyboard/comic to their students. The goal of using these approaches is to promote student engagement and higher order thinking.

Figure 11: The author used this *Pixton* comic in an online class for pre-service teachers. It introduced a new learning module and content relating to brainstorming strategies for reinforcing new knowledge.



Both Figure 11 and Figure 12 show how the teacher can introduce new content via the engaging format of a comic. In Figure 12, a pre-service teacher and a student in the author’s technology foundations course used *Storyboard That* to introduce a new concept to a group of first graders.

Figure 12. A pre-service teacher and student in my class on Foundations in Educational Technology created this comic to introduce young learners to the benefit of search engines.



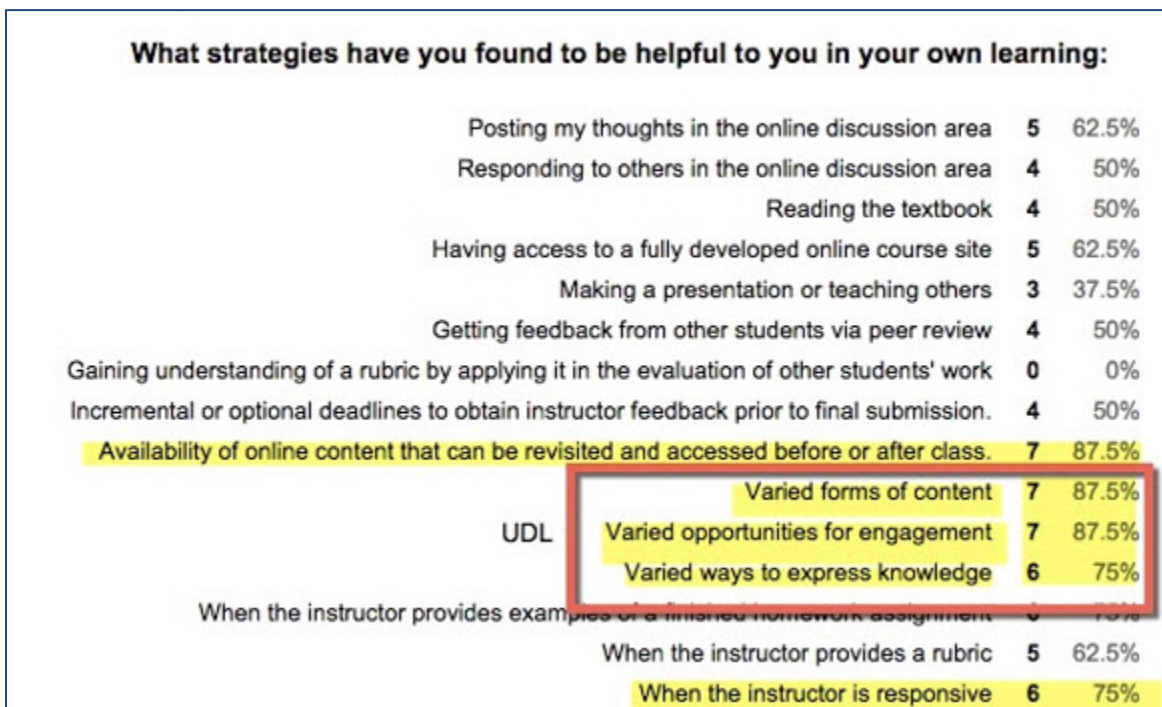
In general, comic strips and storyboards have support in the literature as tools that can assist a wide range of diverse learners in the area of both receptive and expressive communication. The tools that support this work are readily available and – as in the case of graphic organizers – comics and storyboards can be implemented with low tech or no tech approaches as well as through a variety of free tools on the Internet.

RESULTS

Based on information in the literature, feedback from students, and the author’s experience and observations, many learners – including those on the autism spectrum – are responsive to visual approaches via both receptive and expressive modalities. Students have been highly responsive to the use of graphic organizers and comic strips from their perspectives as college students engaging in learning and also from the standpoint of pre-service teachers being asked to adopt these approaches with their own special education or general education students. This paper has described and demonstrated three visual approaches that may be used in the context of AT services or devices to promote success among students with special needs. Ideally, teachers in general education settings can also adopt some of these ideas and approaches for the benefit of teaching and learning.

Future research will expand upon these findings further. However, when seeking to identify approaches diverse students find helpful in their own learning, the descriptive questions and student endorsement of multiple means of engagement, representation, and action and expression provided clear support for UDL approaches (CAST, 2017). As seen in Figure 13, this preference for UDL was demonstrated by students without the potential bias of actually naming the UDL model in the survey questions provided.

Figure 13. Without prompting as to the approach being used, students identified the usefulness of the three domains or strategies that comprise Universal Design for Learning (UDL).



CONCLUSIONS AND FUTURE STUDY

This paper described creative uses of these visual and supportive tools and services represented by graphic organizers, comic strips, and UDL. It also explored their advantages through the literature and shared initial responses from students in the Teacher Preparation Program at Nevada State College. In so doing, this case study forms the foundation for future and ongoing implementation. With the goal being to quantify the benefits identified here, this project suggests the need for further study and a systematic process to measure ways UDL, graphic organizers, and comic strip creations can benefit students as (1) a form of assistive technology, and (2) as a means of enriching general education classrooms with visual, engaging, and constructivist approaches to teaching and learning.

AUTHOR BIOGRAPHY

Sarah Bryans-Bongey, Ed.D. is Assistant Professor of Education at Nevada State College. She holds a doctorate in Teaching and Learning, an M.Ed in Educational Media and Technology from the College of St. Scholastica, and a certificate in Assistive Technology Applications from CSU-Northridge. Her research interests include online learning, educational technology, supporting diverse learners, and Universal Design for Learning (UDL). Her research on UDL and teaching with technology has led to numerous publications and presentations, including journal articles and a chapter in the award-winning book, *Dancing with Digital Natives: Staying in Step With the Generation That's Transforming the Way Business is Done*. She also co-edited the 2016 book, *Online Teaching in K-12: Models, Methods and Best Practices*.

REFERENCES

- Barkley, E. F., Major, C. H., & Cross, K. P. (2014). *Collaborative learning techniques: A handbook for college faculty*. San Francisco, CA: Jossey-Bass.
- Bryans-Bongey, S., Hughes, T., Scherer, A. (2012, May). Presented at *14th Annual International Conference on Education: Evaluating learning management system (LMS)-facilitated delivery of universal design for learning (UDL) in postsecondary education*. Athens: Athens Institute for Education and Research (ATINER). Published online at: <http://www.atiner.gr/papers/EDU2012-0058.pdf>.
- Center on Disabilities, California State University, Northridge (2013). *Module 2: Introduction to assistive technologies*. 1-14.
- Center for Applied Special Technology. (2017). *Universal design for learning*. Retrieved from <http://www.cast.org/udl>
- Culbert, E, Flood, M., Windler, R, & Work, D. (1998). A qualitative investigation of the use of graphic organizers. *ERIC Report*. Alexandria, VA.
- Dell, A., Newton, D., & Petroff, J. (2017). *Assistive technology in the classroom: Enhancing the school experiences of students with disabilities* (Third edition. Ed.). Boston: Pearson.
- Edyburn, D. (2015). *Efficacy of assistive technology interventions*. Retrieved from <http://www.ebilib.com>
- Glaeser, B. G., Pierson, M. R., & Fritschmann, N. (2003). Comic strip conversations. *Teaching Exceptional Children*, 36(2), 14-19.
- Hitchcock, C., & Stahl, S. (2003). Assistive technology, universal design, and universal design for learning: Improved learning opportunities. *Journal of Special Education Technology*, 18(4), 45-52.
- Rose, D. H., & Meyer, A. (2002). *Teaching every student in the digital age: Universal design for learning*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Suwastomo, B. (2016). Teaching using comic as a media to improve student's vocabulary mastery. *STUDIA*, 1(1), 1-22.
- Singleton, S. M., & Filce, H. G. (2015). Graphic organizers for secondary students with learning disabilities. *Teaching Exceptional Children*, 48(2), 110-117.
- U.S. Census Bureau (2010). Retrieved from <https://www.census.gov/prod/2011pubs/acsbr10-12.pdf>
- Zabala, J. S. (2005). *Using the SETT framework to level the learning field for students with disabilities*. Retrieved from: <http://www.joyzabala.com>

NOTES