

# Leveraging Technology to Remove Barriers (Not Create Them)

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## **Abstract**

*In a world of iPads, chromebooks, learning management systems, and a billion-dollar education technology industry, it is easy to get enticed to use technology tools that promise to improve learner outcomes, make learning easier, or engage the digital natives in our classrooms. While technology can power our learning, without the UDL framework as a guide, it is a tool without a purpose and a source of disengagement for learners. This paper explains the importance of using UDL as a research-based method for applying classroom technologies, steps for successful technology incorporation, and examples of how teachers can use specific tools to enhance the learning environment to engage learners.*

## **Keywords**

Implementation; Technology; Instruction; EdTech

## **INTRODUCTION**

Classrooms of the 21<sup>st</sup> century are increasingly made up of learners who have spent their entire lives surrounded by readily available, stimulating technology. At the same time, teaching and learning have changed dramatically. In the U.S., the educational technology industry surpassed \$1.45 billion in 2018, while global edtech industry markets grew to a historic \$9 billion, a 30% increase from 2016 (Wan, 2019; Shulman, 2018). Similarly, the use of 1:1 devices in classrooms have also increased dramatically over the last three years (Bernstein, 2019). With new educational technology tools flooding the market daily, new technology can be seductive to teachers looking for fast and innovative ways to increase learning outcomes in the classroom. Technology may seem like a natural choice for engaging technology savvy students. Technology can certainly help provide flexible learning options and make tasks easier. However, using new edtech tools without proactive planning will not create the truly engaging learning environments learners deserve. While we may be excited to use new technologies, introducing them without a framework to guide our decision-making may give learners more inclination to disengage. In order to create engaging learning environments and develop expert learners, we must not fall victim to the “cool” factor of new technology tools. Instead, we must select classroom technologies with purpose, reflection, and careful planning, with a focus on staying true to the UDL guidelines. When we follow the guidelines, technology can truly be used to excite, empower, and motivate.

## **THE ROLE OF TECHNOLOGY IN UDL**

Universal Design for Learning (UDL) emphasizes providing students multiple avenues for learning based upon neural networks that [reflect] the “what”, “how”, and “why” of teaching and learning. One of the goals [of] UDL is to reach all learners, and newer technologies can give teachers the power and flexibility to individualize and customize the learning experience” (Rose, Gravel, and Domings, 2010)). Though technology is not a necessity in the implementation of UDL, technology can certainly be leveraged to provide options for learners and thereby create more engaging environments.

## **FIRST: START WITH THE GOAL**

In the UDL framework, it is important that educators focus on the learning goals when designing lessons. Just as it is important to create clear, specific learning goals for our students, we need to make sure the connection between the goal and technologies are also clear. When we introduce technology into the classroom, we must also focus on the learning goal. We must ask ourselves if a particular technology helps learners reach a goal, aligns with the goal, and ask what *true* purpose the technology serves in learning.

Does the “coolness” of the technology tool drive the decision to incorporate it into a learning environment? Or, does this technology tool help learners reach their learning goal in an innovative way? Does this technology tool challenge learners to do the “hard things” in the classroom? In the billion-dollar world of educational technology, we must not fall victim to flashy new tools and ideas. All learning environment technology decisions must support the learning goals and the means students use to achieve them. As educators, we must demonstrate that we are expert learners in designing our learning environment by being purposeful when utilizing educational technology.

## **Example: Purpose, UDL, and Resource Adoptions**

For technology to truly enhance the learning environment, we must rely on the UDL framework to ensure that technology is used in a coherent, meaningful, purposeful way. In my home district of Bartholomew Consolidated School Corporation in

Columbus, Indiana, UDL provides the instructional framework, comprises the largest portion of our teacher success rubric, and drives decisions about what technology tools are adopted at district, subject area, school, and classroom level. As a school district, our mission is to deepen learning and create expert learners. We select resources based on a thoughtful, reflective process that supports UDL implementation and gives top priority to enhancing learning environments. For an example of this purposeful process, see Appendix Item 1, which shows a sample rubric used by a resource adoption committee at the secondary level for subject area adoption cycles. Teachers in this committee must examine in depth the digital curriculum options available for adoption, identify how the curriculum resource aligns with UDL, and reflect on how the tool improves learning. These committees must identify any weaknesses of tools and work alongside UDL coaches before proposing a curriculum resource for final review by curriculum directors. This practice of being purposeful with our technology decisions has allowed our district to make sure we do not commit random acts of improvement, but promote meaningful progress towards the goal of creating expert learners through well designed learning environments.

### **NEXT: PLAN FOR VARIABILITY AND ACCESSIBILITY**

As emphasized in the UDL framework, learner variability is something educators must plan and design for in learning environments. If we are using UDL as our framework, we cannot bring technology into our learning environment as part of a one-size-fits-all approach. “As more and more students are turning to the cloud [and technology] for learning, it’s more important than ever that instructors have a solid understanding of how to design learning opportunities to minimize barriers and maximize engagement” (Novak and Thimbodeau, 2016). By only allowing one way to engage with the learning, we communicate to our learners that they are not valued. Similarly, when we choose to utilize technologies without considering what barriers may exist in their functionality or design, we send a message to our learners that they do not belong in our learning environment. If we truly want to create engaging learning environments, we must provide learners with options for interacting with their learning and make sure the options we select welcome all learners no matter where they might be, what skills they may have, or what skills they have not yet mastered. When we plan for variability and focus on accessibility when selecting technology tools, we allow learners to become the architects of their learning and minimize threats and distractions, the key elements of capturing learner engagement.

### **Example: BCSC LEDs**

In addition to utilizing a rubric-format of the UDL guidelines to make purposeful, UDL-informed technology decisions, BCSC teachers plan for variability and accessibility when making learning environment decisions at the classroom level, thanks to assistance from UDL facilitators (UDL expert coaches in school buildings) and the district’s teacher success rubric. These decisions may include technology, but should focus on how to plan for learner variability in BCSC classrooms. In BCSC alone, there are many different schools (11 elementary, 1 Pre-K, 5 secondary, 3 alternative education), many students (11,500 students), and many languages (58 different languages spoken).

Teachers collaborate with expert UDL coaches (UDL facilitators) in their buildings to provide accessible options for meeting the variabilities in their learning environments. Facilitators use a Learning Environment Design form (see Appendix 2) to assess the learning environment, including how edtech tools are used to address variability, and what barriers tools may create for learners. The facilitator can assist teachers in completing this form and provide one-on-one assistance. Through this collaboration, teachers gain insightful perspectives about the variability in their classrooms and additional methods that can be used to create engaging, inclusive spaces.

### **FOCUS ON THE GUIDELINES: ENGAGEMENT**

The UDL principle of Engagement focuses on the “why” of learning. This includes interest level, effort, tenacity, and self-regulation. While all UDL principles are important, engagement is crucial because it plays an important role in sparking initial interest to learn, sustaining learning despite challenges or setbacks, and providing motivation to learn overtime. Engagement is a necessary and important first step when designing learning environments. Research shows that “those students who are motivated by and engaged in learning tend to perform considerably higher academically and are better behaved than unmotivated and un-engaged peers.” (Stephens, 2015) “At the core of teaching is the motivational foundation for learning and for preparing students for a lifetime of further, intrinsically motivated learning.” (Rose, Gravel, Domings, 2010) Therefore, focusing on the engagement guidelines must be the core element when designing learning environments and selecting educational technologies.

### **Options for Recruiting Interest**

Learner engagement is one of the most crucial elements in learning, but also a challenge for teachers. “Students differ markedly in the way in which they can be engaged or motivated to learn.” (Rose and Meyer, 2002). Engagement is influenced by many factors, such as culture, personal relevance, neurology, background knowledge, and more. Teachers can recruit student interest by focusing on providing options, as “no one means of engagement will be optimal for all students” (Rose and Meyer, 2002). Teachers can give students choices in learning resources or tasks, help students make personal connections to learning topics,

and create a safe space for learners. Virtual reality technology tools (both free and high end) can help support the UDL checkpoints for recruiting interest guidelines.

#### *Example Tools: Google VR Applications and Websites*

For example, Google's free virtual reality tools can be leveraged to recruit interest in learners because the tools can help create more relevant, valuable and authentic learning experiences by bringing faraway places and distant time periods to life. For example, students learning about the ancient culture of the Chinese could explore the incredible feats of engineering at the Great Wall of China in Google VR and even "walk" along the same bricks of the wall as the Chinese did thousands of years ago. Students could explore places of their own family history, culture, or ethnicity. The immersive experiences of VR can help make this subject area content more relevant to learners, and also "increase transfer of knowledge and interest to reach rigorous learning goals because of increased personal connections to the learning topic(s)" (Rose and Meyer, 2002).

Virtual reality tools can also help minimize threats and distractions for learners by when their use is carefully planned. For instance, VR can be used to provide students a learning resource option that is less threatening in terms of reading or text, because the content is primarily visual with short excerpts of text. On the other hand, VR can also create threats and distractions if it is provided as the only learning option. The visuals in VR may prove to be too stimulating for some learners. When opting to use VR in the classroom to create engaging learning experiences, it is imperative to turn to the UDL guidelines for guidance, provide VR as an option, calculate a pre-determined amount of time students spend with VR tools, and build in time to train students first.

#### **Options for Sustaining Effort and Persistence**

Technology tools can also be utilized to provide many opportunities to sustain learner effort and persistence in the learning environment. In particular, educational gaming tools can help learners understand the value of their efforts, vary challenge, and foster collaboration.

#### *Example Tools: Google Keep, Wakelet*

Google Keep is a free tool that allows users to create their own virtual sticky notes, lists, or collections. Similarly, another free tool that can assist this aspect of the UDL guidelines is Wakelet. Like Google Keep, Wakelet is a tool that allows teachers or learners to curate "collections" of content. Collections can be websites, Tweets, videos, text typed by the user, photos, PDFs, Google Drive files, and more. Many individuals can collaborate on a Wakelet collection at once. Both Wakelet and Google Keep are tools that can help heighten the salience of goals and objectives by providing an option, or means, for students to record progress towards goals, practice using digital scheduling tools, and develop a system for breaking down larger goals into simpler, short term goals. Learners and teachers can collaborate on notes in Google Keep to track student progress. Both tools can also be used by the teacher to share individual, group, or class to-do lists or notes to help learners stay on task.

Wakelet and Keep can also be utilized to provide alternative tools and scaffolds to help students learn content and build new skills. Students can create simple or complex collections in both tools, which gives them flexibility and choice to optimize challenge. "All learners need to be challenged", according to the UDL Guidelines, "but not always in the same way". By providing learners with a range of demands and possible, flexible resources, all learners can find challenges that are motivating (CAST). The ability to add many resources into Wakelet and Keep allows students to use varying methods for monitoring their progress, from lists, to images, to charts, to video responses, all in one collection.

Google Keep and Wakelet are tools that foster collaboration because they can be shared by more than one user. They can all be working on the same collection at the same time to organize tasks in projects, assign roles, set due dates, gather research, and more. Collaboration is an important component in sustaining effort and persistence because it allows learners time for active processing of concepts (CAST). Through these tools, students have the opportunity to work with and speak to one another. In project-based, middle school classrooms in BCSC, learners use Google Keep to map project resources, assign roles, track progress, compile research, and create task lists so groups can be successful. In a middle school, 8<sup>th</sup> grade classroom, students use Wakelet to disseminate helpful advice and connect with 7<sup>th</sup> grade peer buddies.

#### **Options for Self-Regulation**

Technology tools can also be utilized to provide options for self-regulation, an important part of human development. In particular, tools like Go Formative and Google Forms can be used to help facilitate coping strategies and develop reflective practices.

#### *Example Tools: Go Formative, Google Forms*

Google Forms are a G-Suite product that teachers can use to create surveys or quizzes. Teachers can create a Google Form that asks students to reflect upon their progress towards a learning goal, after completing a group project, or to gather information on what topics motivate and interest them, and what they would like to do in the classroom. An important part of teaching self-

regulation is helping the learner identify what motivates them. Using a Google Form helps support the guideline of “develop self-assessment and reflection”. It allows students to practice reflection and provides teachers with a means to gather data which can then be turned into charts, aids, and displays to help learners understand their progress towards goals. Like Google Forms, Go Formative can also be used to create “surveys” or ask questions to help develop reflection skills and promote beliefs that optimize motivation. Plus, the unique question types in Go Formative can also be leveraged to help students cope with challenges or setbacks in learning. A whiteboard question type in Go Formative, allows the learner to draw freely. This feature may be beneficial if used to provide a sensory experience for a student who may be on the brink of an outburst in class. Questions can also be utilized to gauge how students are feeling at any point in a lesson in order to help teachers identify which students may need additional assistance.

## REFLECTION AND ITERATION

Just as educators expect learners to reflect upon their own learning in order to build an understanding of strengths and challenges, we as educators must also reflect upon our learning environment to identify areas for celebration and improved design. Gathering feedback from learners is key. If we do not ask our students for feedback and adjust curriculum based upon their feedback, how can our learning environment truly be learner-centered? How can we possibly know if we are making progress? How do we know if we are engaging our learners, or using technology that suits them? Using the same lessons, syllabi, and technology tools year after year may serve our own interests, but may not be in the best interests of learners. Use a reflection tool like the LED (Appendix 2) and your students to gather feedback. Try not to take the criticism personally. Ask yourself if the technology tool was purposeful and supportive of the UDL guidelines. Did it enhance the learning environment, or were more barriers created? If the tool created barriers, this does not mean it can never be used again, but needs to be used with careful planning and scaffolding. Ask colleagues or instructional coaches to reflect upon your learning environment. As educators, we can become possessive of our own lessons because of the time spent creating them. It is in the best interest of our students to step back and welcome well-meaning feedback. This cycle of reflection, redesign, and repetition is crucial not only to improving our craft, but also to helping ourselves stay true to the UDL guidelines (Johnson, 2018). Our learners vary from day to day, year to year, hour to hour. Learning environments must reflect this variability.

## CONCLUSION

The use of educational technology tools is likely to increase in our learning environments as technology innovation continues to grow, and the edtech industry continues to boom. The UDL framework provides educators a means to implement educational technologies in a coherent, purposeful, engaging way. By focusing on the purpose of the technology tool when designing learning environments, and planning for variability, educators have research-based methods to better ensure that technology serves all all learners, rather than satisfies the urge to stay up to date on the next “trend” or “cool” technology tool. By focusing on the UDL guidelines and using technologies that can best support engaging students, we can help our learners become excited, empowered, and motivated to continue learning.

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<https://www.edsurge.com/news/2019-01-15-us-edtech-investments-peak-again-with-1-45-billion-raised-in-2018>

**Table 1. BCSC Resource Adoption Rubric**

<b>BCSC Resource Adoption Rubric</b> 1=Ineffectual, 2=Sufficient, 3=Good, 4= Exceptional				
<b>I. Provide Multiple Means of Engagement</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<p>1: Provide options for recruiting interest</p> <ul style="list-style-type: none"> <li>○ Materials engage students and encourage inquiry</li> <li>○ Materials offer choices for meeting different learner needs (EL, high ability, struggling learners &amp; auditory, visual, kinesthetic learners)</li> <li>○ Materials offer a variety of primary sources (modified, diverse, engaging, and balanced)</li> </ul> <p><b>Score/Overall Impression:</b></p>				
<p>2: Provide options for sustaining effort and persistence</p> <ul style="list-style-type: none"> <li>○ Materials provide student choice at differentiated levels</li> <li>○ Assessments leveled for all learners</li> <li>○ Materials lend themselves to various student reflections</li> <li>○ Materials provide suggestions for collaborative learning</li> <li>○ Materials offer options for formative and summative assessments</li> </ul> <p><b>Score/Overall Impression:</b></p>				
<p>3: Provide options for self-regulation</p> <ul style="list-style-type: none"> <li>○ Rubrics or checklists are present for student self-assessment of and reflection on learning</li> <li>○ Materials ensure skills and support to read, write and analyze critically</li> </ul> <p><b>Score/Overall Impression:</b></p>				
<b>II. Provide Multiple Means of Representation</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<p>4: Provide options for perception</p> <ul style="list-style-type: none"> <li>○ Digital material is able to be manipulated (closed caption, font size, sound amplified)</li> <li>○ Material is accessible anywhere on any device</li> <li>○ Material is deliverable in different modalities including auditory and visually (read-alouds and transcripts)</li> <li>○ Options to upgrade materials and digital versions as current events and technologies change</li> </ul> <p><b>Score/ Overall Impression:</b></p>				
<p>5: Provide options for language, mathematical expressions and symbols</p> <ul style="list-style-type: none"> <li>○ Materials support ELL students and cultural diversity</li> <li>○ Materials support literacy strategies (fluency, vocabulary, comprehension, composition)</li> <li>○ Materials are flexible for teaching (scaffolding options, modified primary sources)</li> </ul> <p><b>Score/Overall Impression:</b></p>				
<p>6: Provide options for comprehension</p> <ul style="list-style-type: none"> <li>○ Materials supply background knowledge</li> <li>○ Materials address current events</li> <li>○ Materials provide modeling strategies</li> <li>○ Materials are relevant, current, authentic and offer diverse perspectives</li> <li>○ Multiple examples of scaffolding are included</li> <li>○ Materials support interdisciplinary studies</li> <li>○</li> </ul> <p><b>Score/ Overall Impression:</b></p>				
<b>III. Provide Multiple Means of Action and Expression</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>

<p>7: Provide options for physical action</p> <ul style="list-style-type: none"> <li>o Supplemental interactive materials (simulations, demonstrations)</li> <li>o The interactive/collaborative activities are not all technology based</li> <li>o Materials are accessible and compatible with itslearning and current hardware</li> </ul> <p><b>Score/Overall Impression:</b></p>				
<p>8: Provide options for expression and communication</p> <ul style="list-style-type: none"> <li>o Materials come with interactive tools (games, timelines, maps)</li> <li>o Materials provide options for assessment</li> <li>o In addition to tools (e.g., dictionaries, thesauruses), materials provide exemplars</li> </ul> <p><b>Score/Overall Impression:</b></p>				
<p>9: Provide options for executive functions</p> <ul style="list-style-type: none"> <li>o Materials align with Indiana standards</li> <li>o Materials allow students to set goals, monitor their progress and encourage and support that process</li> <li>o Materials give strategies for students to reflect on their learning</li> </ul> <p><b>Score/Overall Impression:</b></p>				

Note: Adapted from the Universal Design for Learning Guidelines version 2.2

**Table 2. Learning Environment Design Form, Blank**

**Learning Environment Design Form (LED, Blank)**

Multiple Means of Engagement	Multiple Means of Representation	Multiple Means of Action/Expression
Resourceful, knowledgeable learners	Strategic, goal-directed learners	Purposeful, motivated learners
Provide options for self-regulation -Promote expectations & beliefs that optimize motivation -Facilitate personal coping skills & strategies -Develop self-assessment & reflection	Provide options for comprehension -Activate or supply background knowledge -Highlight patterns, critical features, big ideas & relationships -Guide info processing, visualization & manipulation -Maximize transfer & generalization	Provide options for executive function -Guide appropriate goal-setting -Support planning & strategy development -Facilitate managing info & resources -Enhance capacity for monitoring progress
Space for evidence, reflection, feedback, etc.	Space for evidence, reflection, feedback, etc.	Space for evidence, reflection, feedback, etc.
Provide options for sustaining effort and persistence -Heighten salience of goals & objectives -Vary demand & resources to optimize challenge -Foster collaboration & community -Increase mastery-oriented feedback	Provide options for language, mathematical expressions and symbols -Clarify vocabulary & symbols -Clarify syntax & structure -Support decoding of text, math notation & symbols -Illustrate through multiple media	Provide options for expression and communication -Use multiple media for communication -Use multiple tools for construction, composition -Build fluencies with graduated levels of support for practice & performance
Provide options for recruiting interest -Optimize individual choice & autonomy -Optimize relevance, value, & authenticity -Minimize threats & distractions	Provide options for perception -Offer ways of customizing the display of info -Offer alternatives for auditory info -Offer alternatives for visual info	Provide options for physical action -Vary the method for response & navigation -Optimize access to tools & assistive technologies

**Note: Adapted from Universal Design for Learning Guidelines version 2.2 by CAST,** Retrieved from <http://udlguidelines.cast.org>

**Table 3. Partially Completed LED Form**

## Sample of Partially Completed Learning Environment Design Form

For each of the UDL guidelines below, please identify all the options that are available for every student in the learning environment (classroom) on a daily basis. This may be completed by the individual requesting assistance or with the assistance of the building administrator, department chair, UDL Facilitator, UDL Instructional Coach.

<p style="text-align: center;"><b>Provide Multiple Means of Engagement</b></p> <p style="text-align: center;"><i>Purposeful, motivated learners</i></p>	<p style="text-align: center;"><b>Provide Multiple Means of Representation</b></p> <p style="text-align: center;"><i>Resourceful, knowledgeable learners</i></p>	<p style="text-align: center;"><b>Provide Multiple Means of Action &amp; Expression</b></p> <p style="text-align: center;"><i>Strategic, goal-directed learners</i></p>
<p><i>Provide options for self-regulation</i></p> <p>9.1 Promote expectations and beliefs that optimize motivation</p> <p>9.2 Facilitate personal coping skills and strategies</p> <p>9.3 Develop self-assessment and reflection</p> <div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> <li>● Song playing during the Bellringer adds interest                             <ul style="list-style-type: none"> <li>● Absent work shared for students (reducing distractions)                                     <ul style="list-style-type: none"> <li>○ All class work or assignments available for students</li> </ul> </li> <li>● Class supplies provided for students (pencils, rulers, glue, etc.)</li> <li>● “Real Life” examples                                     <ul style="list-style-type: none"> <li>○ Roller coasters</li> <li>○ Minute to Win It games</li> <li>○ Rocks (specific to Indiana)</li> </ul> </li> </ul> </li> <li>● Rainbows (formation, double rainbows)</li> </ul> </div>	<p><i>Provide options for comprehension</i></p> <p>3.1 Activate or supply background knowledge</p> <p>3.2 Highlight patterns, critical features, big ideas, and relationships</p> <p>3.3 Guide information processing, visualization, and manipulation</p> <p>3.4 Maximize transfer and generalization</p> <div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> <li>● Current events (extra credit)                             <ul style="list-style-type: none"> <li>● Connection to other classes - one-step equations, mineral crystals, etc.</li> <li>● Question of the day - “Remember when we covered...”</li> <li>● Songs from “real life” used to connect science background                                     <ul style="list-style-type: none"> <li>○ EX – rotten to the core</li> </ul> </li> </ul> </li> </ul> </div>	<p><i>Provide options for executive functions</i></p> <p>6.1 Guide appropriate goal-setting</p> <p>6.2 Support planning and strategy development</p> <p>6.3 Facilitate managing information and resources</p> <p>6.4 Enhance capacity for monitoring progress</p> <div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> <li>● Song during bellringer is used to signal start time for class                             <ul style="list-style-type: none"> <li>● Weekly agenda posted</li> <li>● Provided time to fill in Blue Book</li> <li>● Colors on board signal students what to do first, etc.</li> <li>● Question of the day sheet</li> <li>● Absent work posted for students</li> <li>● Checklists provided for students to use during work time                                     <ul style="list-style-type: none"> <li>○ EX – station work</li> </ul> </li> </ul> </li> <li>● “To Do” slide posted for students to begin working/prepping for class</li> </ul> </div>

**Note: Adapted from Universal Design for Learning Guidelines version 2.2 by CAST,** Retrieved from <http://udlguidelines.cast.org>