

# Guides and Templates: A New Approach to Universal Design for Learning in Blended and Online Courses

by

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requirements for the degree of Master of Design in Inclusive Design

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## **Abstract**

This research paper and the accompanying prototype (demonstrate and explain a lesson planning guide that supports the design and implementation of curricula that adhere to the principles of Universal Design for Learning (UDL). It argues that existing UDL planning and implementation resources are not well-integrated within educators existing practices and tend to lack comprehensive support related to creating diverse, accessible content. The prototype demonstrates integration of a UDL guide into a Learning Management System (LMS) and the use of existing Open Educational Resources (OER) to structure and scaffold the choices and workflows presented to educators. In particular, it showcases how dividing design and implementation decisions into steps, promoting best practices through templates and making it easy to share work increases the viability of educators creating and using content and teaching methodologies that align with the principles of UDL.

You can find the accompanying prototype at:

<http://www.sandraearl.com/udlguide>

## **Acknowledgements**

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## **Project Definition and Problem Statement**

This document and the accompanying prototype ([www.sandraearl.com/udlguide](http://www.sandraearl.com/udlguide)) satisfy the written and applied requirements of a graduate level major research project in the field of inclusive design. The project applies understandings from the intersecting fields of user interface design, instructional design and accessible information and communication technologies towards a practical and novel solution to a problem identified through literature reviews, end user interviews and heuristic reviews of existing resources.

Specifically, the prototype design and research paper demonstrate and explain a lesson planning guide that supports the creation of curricula that adhere to the principles of Universal Design for Learning (UDL).

UDL is a popular instructional design model that supports the development of instructional goals, methods, materials and assessments that account for students' unique learning needs and interests. Its main objective is to equalize and enhance learning outcomes by ensuring information is represented, knowledge is demonstrated and engagement is fostered in multiple ways. It provides an excellent framework for ensuring learning plans align with legislation related to inclusive education regardless of the identified accommodation needs of students within a particular class. Despite UDL's broad appeal, educators often lack the time or expertise to find, assess and implement the resources and technologies required to effectively implement it. Existing UDL planning and implementation resources are not well-integrated within educators existing practices and tend to lack comprehensive support related to creating diverse, accessible content.

This design project recommends integrating a UDL lesson planning workflow that utilizes existing Open Educational Resources (OER) within a Learning Management System (LMS). LMS are widely used in both traditional (blended) and fully online classrooms by students of all ages, and are a key component of many institutions' existing technology strategies. By design, they provide a framework for integrating and delivering diverse learning materials. Finally, they

have the potential to enforce accessible mediums and provide analytics on student engagement and outcomes – allowing instructors to focus on teaching. Similarly, OER repositories promote the sharing and revision of quality educational resources, greatly increasing the diversity of resources available and the viability of instructors finding and creating multiple resources for the same learning goals.

Unfortunately, most LMS are intentionally agnostic towards instructional design practices and, therefore, instructors lack guidance on how to effectively combine activities and resources. Likewise, most OER focus on the academic and presentation-related quality of content and ignore accessibility barriers presented by the delivery format. This design overcomes these barriers and the shortcomings of existing UDL resources by embedding a guide within an LMS. This guide provides scaffolds for organizing, selecting and planning appropriate resource and activity types. It assumes that educators have deep knowledge of their subject areas and teaching goals, but could benefit from software that helps them plan and deliver lessons that leverage the affordances of technology.

A guide, in this context, is defined as a user interface design that divides a larger task into manageable sequences or steps. These tasks do not have a rigid order, but are appropriately structured to support lengthy or complex transactions. (Baxley, 2004) Given that the graphic design, interaction design patterns and development framework are largely dependent on the LMS design, the focus of evaluation for this design should be whether its features and workflows effectively support the creation of comprehensive UDL curricula.

The guide is designed to support educators and students across disciplines, teaching levels and organization types; however, a particular focus is placed on U.S. higher education instructors that teach blended courses (LMS and other learning technologies are used in conjunction with face-to-face activities and instruction). (Alan and Seaman, 2009) Six interviews with post-secondary educators in North America who have experience applying UDL or Universal Instructional Design within LMS directed this focus.

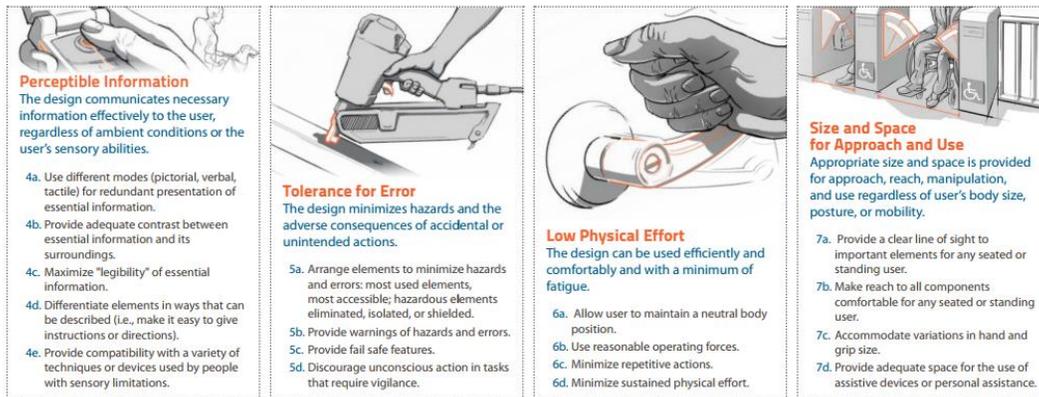
## **Background Research**

### **What is Universal Design for Learning?**

Universal Design for Learning (UDL) is a framework developed by the Center for Applied Special Technology (CAST). This framework promotes the development of learning experiences that engage and support all learners, including learner who are “in the margins,” such as gifted learners, learners who require alternative formats for resources or assessments and learners who are motivated by non-traditional knowledge sharing and formulation. “UDL’s basic premise is that barriers to learning occur in the interaction with the curriculum—they are not inherent solely in the capacities of the learner.” (Meyer and Rose, 2005, pg. 8) Thus, curriculum planning should focus on the creation of flexible, proven learning resources that support individual learner differences. (A Route for Every Learner, 2011, pg. 10)

UDL is an extension of and shares a central vision with Ron L. Mace’s principles of Universal Design. Mace explains Universal Design as “the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.” (About UD, 2013) The seven principles of Universal Design are widely applied in many design and engineering fields, including architecture, industrial design and information and communication technologies (ICT).

The Principles of  
**Universal Design**



**Figure 1: Principles of Universal Design Poster from The Center for Universal Design at NC State University**

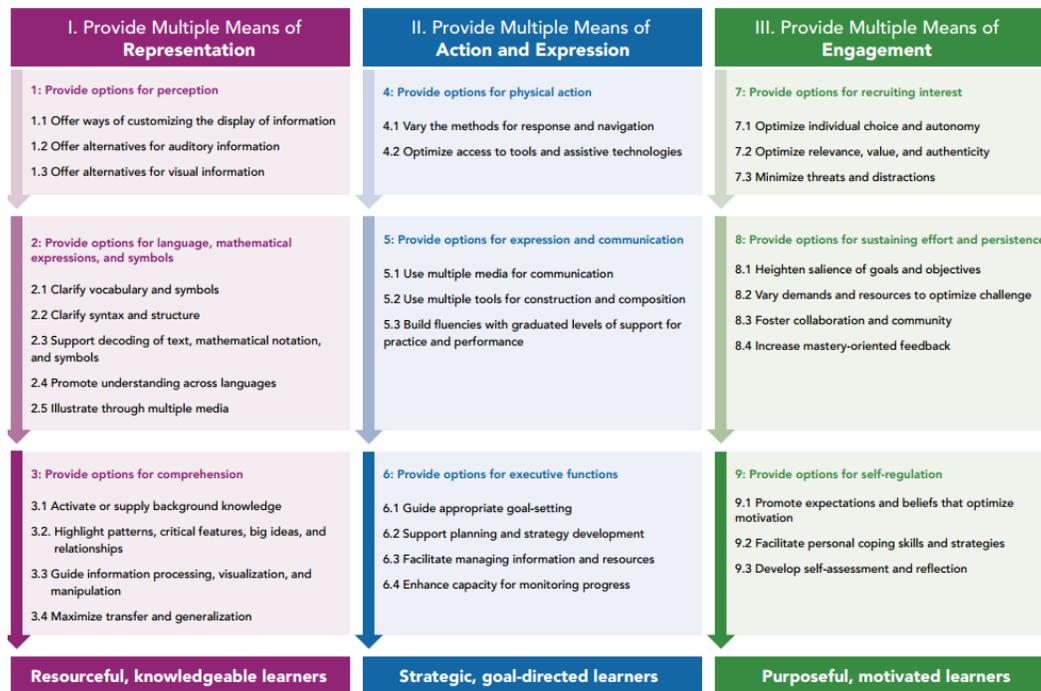
CAST's application of Mace's vision to education assumes there are inherent differences between physical environments and learning environments that result in the need for separate universal design principles for learning. Rose and Gravel clearly explain the difference in *Technology and Learning: Meeting Special Student's Needs* (2010),

UDL emphasizes the special purpose of learning environments – they are not created to provide access to information (that is the role of libraries and the internet) but instead to foster the changes in knowledge and skills that we call learning. While providing access to information is often essential to learning, it is not sufficient. Success also requires that the means for learning – the pedagogical goals, methods, materials and assessments of instruction – are also accessible. UDL is the process by which we attempt to ensure that the means for learning, and their results, are equally accessible to all students. (pg.2)

The framework and guidelines for UDL are not derived from the principles for architecture. Instead, they are based on research and practice from

multiple domains within the learning sciences – education, developmental psychology, cognitive science, and cognitive neuroscience. (pg.2)

The UDL framework advocates that in order for the “means of learning, and their results” to be accessible to all learners, learners must have multiple ways of acquiring, expressing and engaging in learning. The three basic principles of UDL - provide multiple means of representation, action and expression, and engagement - are formed from this premise; they are then subdivided into nine guidelines for successful implementation. (CAST, 2011, Universal Design for Learning Guidelines 2.0)



**Figure 2: Universal Design for Learning Guidelines from CAST**

The UDL framework is a well-researched, detailed curriculum planning, delivery and assessment tool that is applicable to diverse educational contexts. (A Route for Every Learner, 2011, pg. 1-3) However, its strong support in the United States is heightened by its fit with a wide range of legislation and policy; as well as its ability to complement similar popular educational theories and practices. For example, The National Universal Design for Learning Taskforce, which advocates for UDL in federal, state and district education policy, is comprised of

more than 40 organizations, including: American Federation of Teachers, American Foundation for the Blind, Association of University Centers on Disabilities, Council of Exceptional Children, and National Center for Learning Disabilities. (CAST, 2013, About the National UDL Task Force)

### **How does UDL relate to U.S. legislation and public policy?**

When considering UDL in relation to U.S. legislation and public policy there are three overlapping policy areas of particular importance: education, ICT and human rights. In particular, the UDL framework has influenced, been incorporated within and been applied to many educational policies because it helps ensure teaching strategies align with the equality standards outlined in Section 504 & 508 of the Rehabilitation Act (1973), the Americans with Disabilities Act (1990), and the Individuals with Disabilities Education Act (1997).

For example, The Rehabilitation Act is considered “the first major legislative effort to secure an equal playing field for individuals with disabilities.” Section 504 of the Act states that “no otherwise qualified individual with a disability... shall...be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance.” This includes any federally funded K-12 or post-secondary school. Section 508 (with 1998 amendments) requires that federal and state entities that receive federal funding select ICT, including educational technologies, which are accessible to persons with disabilities. (United States Law, 2013)

The Americans with Disabilities Act (ADA) is civil rights legislation governed by the Department of Justice. It is intended to ensure people with disabilities have equal access to programs and services. Title II requires that communications with persons with disabilities be as effective as communications with others. Title III ensures people with disabilities have integrated and equal access to public spaces and services. For example, “Private entities offering [] examinations or courses...must offer them in an accessible place and manner or offer alternative accessible arrangements.” (U.S. Department of Justice, 2013)

The Individuals with Disabilities Education Act (IDEA) ensures free and appropriate public education for students with disabilities, which is typically documented and monitored yearly through Individual Education Plans (IEPs) that outline specific accommodation needs and learning goals for each child. (United States Law, 2013)

Although not officially recognized in U.S. federal legislation, the international web accessibility standards - Web Content Accessibility Guidelines 2.0 (WCAG), Accessible Rich Internet Applications (ARIA), and Authoring Tool Accessibility Guidelines 2.0 (ATAG) - are also important to discuss because of their broad impact on government and educational practices related to ICT accessibility. These standards provide practical checkpoints and examples for ensuring websites and content (WCAG), web applications (ARIA) and web authoring tools (ATAG) are accessible. In 2012, the U.S. Department of Justice issued an Advance Notice of Proposed Rulemaking that asks the question “Should the Department adopt the WCAG 2.0 "Level AA Success Criteria" as its standard for website accessibility for entities covered by titles II and III of the ADA?” (U.S. Department of Justice, 2012) This amendment would align U.S. legislation with similar legislation in Canada, Australia and Europe.

Leading accessibility advocacy groups, such as the National Federation of the Blind (NFB), have affectively used both Section 508 and the ADA in education related lawsuits. For example, in October of 2011, the NFB settled a complaint against Penn State University related to the failure to provide appropriate ICT for students who are visually impaired. (Cummings, 2011)

The UDL guidelines provide a detailed, demonstrable way of ensuring the requirements of these important pieces of legislation are met for all learners. They are particularly important for ensuring accommodations are integrated within regular instructional practices and available to students equally, regardless of identified need. This is accomplished through a focus on learner diversity rather than a single, fixed set of criteria for accessibility.

Universal Design for Learning (UDL) not only provides a strategy for compliance with laws regarding students with disabilities, but can also benefit students with diverse learning styles and abilities. (CELT, 2012)

UDL's strength in ensuring equal learning opportunities for all learners and the responsible use of ICT in education has strongly influenced recent education policies - including the National Instructional Materials Accessibility Standard of 2006, the Higher Education Opportunity Act of 2008 and the National Educational Technology Plan of 2010. Most recently, UDL influenced the Common Core State Standards Initiative to include language supporting expanded access: "...allowing for the widest possible range of students to participate from the outset." (CAST, References to UDL in Public Policy, 2011)

### **How does UDL relate to other curriculum planning and teaching practices?**

The following section is not an exhaustive list or comprehensive review of currently applicable educational theories and practices. However, it is valuable to discuss how UDL complements and supports other popular practices, since this versatility is one of its main attractions as the framework for a lesson planning guide.

As a curriculum planning model, UDL advocates that the first step in planning should be the identification of learning goals. This aligns with many popular instructional design models, including ADDIE, Dick and Carey, and Kemp's Instructional Design Model. (Instructional Design Central, 2012) In fact, since UDL's primary focus is the design of lessons and materials, it can be effectively integrated within all of these models as long as the UDL guidelines are followed during the material design, instruction and assessment phases of the different models.

Furthermore, when UDL is compared to other models with an equal emphasis on supporting learner diversity through resource design, instruction and assessment – such as Understanding by Design, Differentiated Instruction, and Response to Intervention – there is close enough alignment that organizations like the Council

of Exceptional Children and the National Center on Accessible Instructional Materials have created cohesive recommendations for using the approaches together. (Basham, 2007) In the article *Differentiated Instruction, Understanding by Design and Universal Design for Learning: A stable planning approach* (2011) a collection of practitioners discuss how using the three models together provides a stable approach to planning both teaching methodologies and materials. They argue, “attending to the uniqueness of each student's learning requires an open-minded, creative and questioning approach to "backwards design.”

The article *Differentiated Instruction and the Implications for UDL* (Hall, 2003) characterizes the complementary nature of the different models as follows:

When combined with the practices and principles of UDL, differentiated instruction can provide teachers with both theory and practice to appropriately challenge the broad scope of students in classrooms today. Although educators are continually challenged by the ever-changing classroom profile of students, resources, and reforms, practices continue to evolve and the relevant research base should grow. And along with them grows the promise of differentiated instruction and UDL in educational practices. (pg.20)

As previously discussed, the vision behind UDL is the design of lessons that universally meet the needs of all learners. The reality of human diversity and ICT limitations, however, means this is not always possible. UDL and Understanding by Design account for this through the continuous assessment and revision of lesson plans. Differentiated Instruction and Response to Intervention provide other methods for immediately responding to unforeseen needs of learners; through alternative activities and intensified attention respectively.

Similarly, whereas UDL can be seen to balance and extend other learning theories that focus on supporting students with different learning needs, it can also integrate and extend theories and practices that advocate for the use of design solutions that don't necessarily consider flexible use. For example, the UDL framework provides a means of assessing the appropriate delivery and use of

Game Theory, 21<sup>st</sup> Century Skills, and Flipped Classroom practices within broader curriculum plans. On her blog User Generated Education, Gerstein (2011) provides an excellent illustration of how the popular Flipped Classroom model can be grounded within the UDL framework to ensure the needs of all learners are considered. She writes,

[The] post describes the principles of Universal Design for Learning and how they naturally occur when a full cycle of learning, including ideas related to the flipped classroom, are used within the instructional process. (UDL and The Flipped Classroom: The Full Picture)

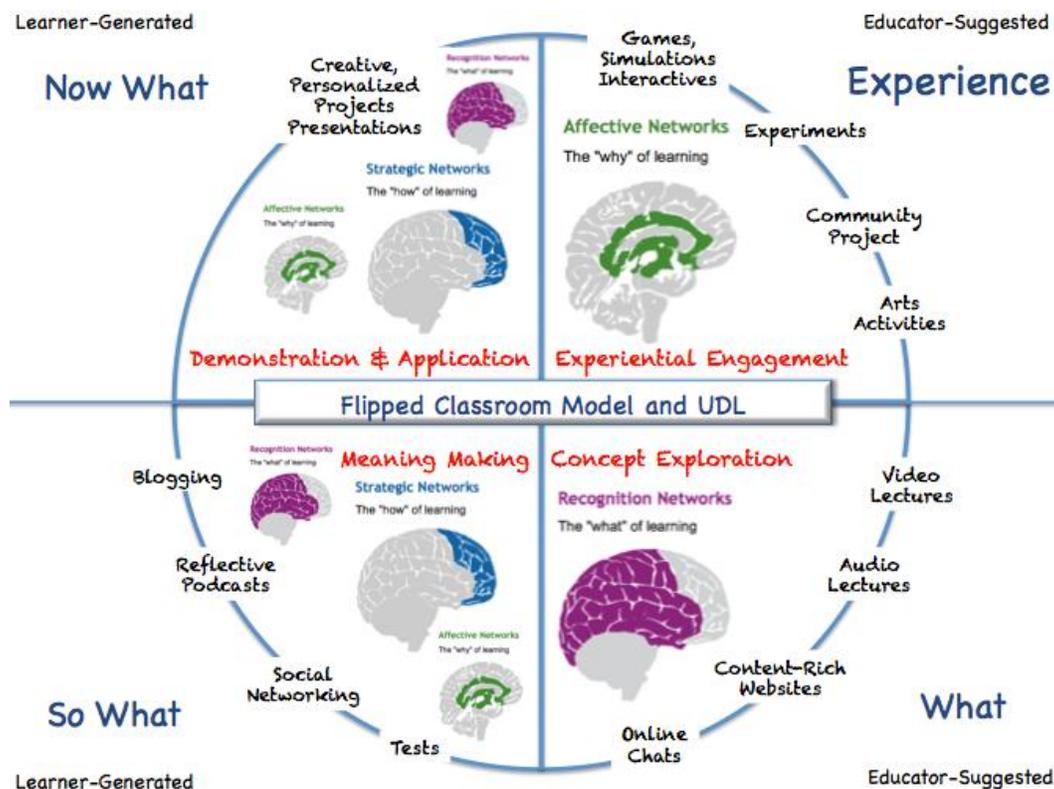


Figure 3: Illustration of a flipped classroom that follows UDL from Jackie Gerstein's blog User Generated Education

In *Technology and Learning: Meeting Special Student's Needs* Rose and Gravel (2010) discuss UDL's similarity to other learning theories influenced by cognitive neuroscience research - in particular, Lev Vygotsky's work on cognitive processes in children and Benjamin Bloom's theory of mastery learning. While

they do not discuss how the different models might complement each other, they do help frame UDL within the broader learning sciences research field.

## **Problem Space**

The previous section attempted to situate UDL within a broader educational context in order to demonstrate its importance and potential as an instructional design model. This section argues that while policy makers, school administrators and educators often agree on the value of UDL, widespread adoption of UDL has not occurred. UDL programs have not fostered the systemic change that CAST and school administrators hoped for, and educators have not implemented UDL guidelines as holistically or consistently as they aspired to.

Consider:

Findings from a research study conducted by CAST and Thomas Hehir Associates Authors (2012),

There appears to be confusion regarding the meaning of UDL at both the state and local district levels...in particular with respect to the relationship between UDL and other initiatives such as differentiated instruction.

Respondents at the state level expressed a desire to receive additional technical assistance and support from organizations, such as CAST, in the implementation of UDL. In particular, they recommended increased availability of web-based resources and online professional development opportunities. (Ralabate, et. al, pg. 12)

Also, the quote below from the article: *Would You Recognize Universal Design for Learning if You Saw It? Ten Propositions for New Directions for the Second Decade of UDL* (Edyburn, 2010),

As someone who has been involved in helping individual teachers as well as schools, states, provinces, and policy makers translate UDL theory into practice, I am concerned about the ability of the profession to implement a construct that it cannot define. (pg. 33)

These musings from a long-time UDL practitioner's blog article *Thinking about UDL...*

I have been sincerely thinking about Universal Design for Learning (UDL) with respect to bringing it from a theoretical level to a pragmatic level that is easily understood by teachers to implement in their classrooms. In thinking about UDL, it struck me...that the problem with UDL is that it is a goal, a state of being, that has not yet been reached and, consequently, has not been experienced. This, I think, or at least is my thinking at this point, is the crux of the issue. We are in the process of moving towards this UDL utopia and, therefore, filling in the blanks. (Wojcik, 2007)

And, finally, this quote from one interviewee for this project,

As much as I would like to say [institution name] wants faculty to follow universal design, I'm not sure how many people outside [learning technology group] would really know the term. So, it works really well if the people developing courses do connect with us, but again there's no policy or procedure in place to make this happen. (Participant 3)

All of these examples suggest that UDL is difficult to explain and implement without scaffolds.

### **Why is UDL so difficult to explain?**

In 2010 Jamie Basham, from the Department of Special Education at The University of Kansas and Jeff Diedrich, State Director of Michigan's Integrated Mathematics Initiative, formed the Universal Design for Learning Implementation and Research Network (UDL-IRN) to identify and disseminate tools and best practices for implementing UDL. Listening to Diedrich speak at the 2012 CSUN conference highlighted that I was not alone in my struggles to evaluate UDL as a learning model. One of the first projects the group undertook was UDL Critical Elements. Instead of focusing on the UDL principles and guidelines, this document frames a holistic view of UDL similar to what you would find when reviewing background information on other instructional design models.

UDL Critical Elements and Instructional Planning Process are a response to the fact that CAST's resources are organized first around the UDL guidelines, second

around validation (brain research) and third around disparate examples of UDL in practice. When navigating the CAST and National Center on Universal Design for Learning websites it is difficult to build a cohesive picture of how to implement UDL. It is easy to find introductory resources focused on the UDL guidelines and isolated classroom examples, but difficult to build an overarching view of the UDL model or implementation workflow. The same is true when reading *Teaching Every Student in the Digital Age* (2002) the most popular book on UDL for instructors. Although the book is insightful and inspiring, it is not until Chapter 5 that teachers are given a sense of how UDL fits within their larger lesson planning processes.

...anyone who has studied the framework of UDL with a focus on implementation, then has attempted to implement UDL across a district, school, or single classroom recognizes that it's more challenging than meets the eye. (Basham, 2012)

In contrast, the Critical Elements and Instructional Process documents created by UDL-IRN provide a holistic view of all of the elements of UDL and a process for implementing the model effectively. They complement the UDL guidelines by helping teachers identify where the guidelines fit into larger planning processes and which guidelines are of particular importance at which stage.

<p><b>Element 1: Clear Goals</b></p> <ul style="list-style-type: none"> <li>• Goals and desired outcomes of the lesson/unit are aligned to the established content standards.</li> <li>• Goals are clearly defined and separate from means. They allow multiple paths/options for achievement.</li> <li>• Teachers have a clear understanding of the goal(s) of the lesson and specific learner outcomes.</li> <li>• Goals address the needs of every learner, are communicated in ways that are understandable to each learner, and can be expressed by them.</li> </ul>
<p><b>Element 2: Intentional Planning for Learner Variability</b></p> <ul style="list-style-type: none"> <li>• Intentional proactive planning that recognizes every learner is unique and that meeting the needs of learners in the margins- from challenged to most advanced- will likely benefit everyone.</li> <li>• Addressing learner strengths and weaknesses, considering variables such as perceptual ability, language ability, background knowledge, cognitive strategies, and motivation.</li> <li>• Anticipates the need for options, methods, materials, and other resources- including personnel- to provide adequate support and scaffolding.</li> <li>• Maintains the rigor of the lesson- for all learners- by planning efforts (1) that embed necessary supports and (2) reduce unnecessary barriers.</li> </ul>
<p><b>Element 3: Flexible Methods and Materials</b></p> <ul style="list-style-type: none"> <li>• Teachers use a variety of media and methods to present information and content</li> <li>• A variety of methods are used to engage learners (e.g., provide choice, address student interest) and promote their ability to monitor their own learning (e.g., goal setting, self-assessment, and reflection).</li> <li>• Learners use a variety of media and methods to demonstrate their knowledge.</li> </ul>
<p><b>Element 4: Timely Progress Monitoring</b></p> <ul style="list-style-type: none"> <li>• Formative assessments are frequent and timely enough to plan/redirect instruction and support intended outcomes.</li> <li>• A variety of formative and summative assessments (e.g., projects, oral tests, written tests) are used by the learner to demonstrate knowledge and skill.</li> <li>• Frequent opportunities exist for teacher reflection and new understandings.</li> </ul>

**Figure 4: UDL Critical Elements from the UDL-IRN**

<p><b>Step 1: Establish Clear Outcomes</b></p> <p>Establish a clear understanding of the goal(s) of the lesson (or unit) and specific learner outcomes relate to:</p> <ul style="list-style-type: none"> <li>• The desired outcomes and essential student understandings and performance for every learner. (What will learning look like? What will students be able to do or demonstrate?)</li> <li>• The desired big ideas and their alignment to the established standards within the program of study that learners should understand.</li> <li>• The potential misunderstandings, misconceptions, and areas where learners may meet barriers to learning.</li> <li>• How will goals be clearly communicated to the learners, in ways that are understandable to all learners.</li> </ul>
<p><b>Step 2: Anticipate Learner Variability</b></p> <p>Prior to planning the instructional experience teachers should have a clear understanding of the barriers associated with the curriculum as it related to learner variability within their environment. Understandings should minimally include:</p> <ul style="list-style-type: none"> <li>• Curriculum barriers (e.g., physical, social, cultural, or ability-level) that could limit the accessibility to instruction and instructional materials.</li> <li>• Learner strengths and weaknesses specific to lesson/unit goals.</li> <li>• Learner background knowledge for scaffolding new learning.</li> <li>• Learner preferences for representation, expression, and engagement.</li> <li>• Learner language preferences.</li> <li>• Cultural relevance and understanding.</li> </ul>
<p><b>Step 3: Measurable Outcomes and Assessment Plan</b></p> <p>Prior to planning the instructional experience, establish how learning is going to be measured. Considerations should include:</p> <ul style="list-style-type: none"> <li>• Previously established lesson goals and learner needs.</li> <li>• Embedding checkpoints to ensure all learners are successfully meeting their desired outcomes.</li> <li>• Providing learners multiple ways and options to authentically engage in the process, take action, and demonstrate understanding.</li> <li>• Supporting higher-order skills and encouraging a deeper connection with the content.</li> </ul>
<p><b>Step 4: Instructional Experience</b></p> <p>Establish the instructional sequence of events. At minimal plans should include:</p> <ul style="list-style-type: none"> <li>• Intentional and proactive ways to address the established goals, learner variability, and the assessment plan.</li> <li>• Establish a plan for how instructional materials and strategies will be used to overcome barriers and support learner understanding.</li> <li>• A plan that ensures high-expectations for all learners and that the needs of the learners in the margins (i.e., struggling and advanced), anticipating that a broader range of learners will benefit.</li> <li>• Integrate an assessment plan to provide necessary data.</li> </ul>
<p><b>Step 5: Reflection and New Understandings</b></p> <p>Establish checkpoints for teacher reflection and new understandings. Considerations should include:</p> <ul style="list-style-type: none"> <li>• Whether the learners obtained the big ideas and obtained the desired outcomes. (What data support your inference?)</li> <li>• What instructional strategies worked well? How can instructional strategies be improved?</li> <li>• What tools worked well? How could the use of tools be improved?</li> <li>• What strategies and tools provided for multiple means of representation, action/expression, and engagement?</li> <li>• What additional tools would have been beneficial to have access to and why?</li> <li>• Overall, how might you improve this lesson?</li> </ul>

**Figure 5: UDL Instructional Process from the UDL-IRN**

## **Why is UDL so difficult to implement?**

UDL-IRN's work shows promise for helping administrators, educators and designers understand UDL as an instructional design practice. However, there remains two impediments to effectively implementing UDL. Firstly, existing resources, including those provided by CAST, build knowledge and understanding, but they do not effectively support action. Educators and instructional designers need more than checklists, books and research papers to effectively plan, deliver and assess technology-based lesson plans. They need tools that facilitate and streamline the process. Secondly, effective lesson planning tools, which are costly and difficult to find or develop, need to be complemented by appropriate resources and assessments.

We are left to our own devices to try to apply the UDL principles to create more accessible accommodations... struggling to achieve the potential of UDL within the current limitations of instructional design and product development (Edyburn, 2010, pg. 36)

The lack of appropriate resources for implementing UDL in the classroom is a widely discussed and acknowledged problem. Most notably, Rose and Meyer (2002) devote a chapter of *Teaching Every Student in the Digital Age* to exploring how the issue could be systemically addressed.

Although change generated from the bottom up is an absolute necessity, there must be systemic change on a regional, state, and even national level if UDL is to be practical...[if] each school or district [were] occupied with creating its own digital material, there would be limited time to build in the smart supports this flexible medium makes possible...

Educational policy needs to demand UDL curriculum, designers need to create it, publishers need to distribute it, teachers need to be prepared to implement it, and professional and parent organizations need to embrace it. (Chapter 8)

Not surprisingly, there are many existing programs that attempt to address the problem from either a sharing perspective: OER and proprietary learning object repositories; or a creation perspective: CAST resource building tools, such as Book Builder and other proprietary educational technologies.

OER is a general term used to describe “digitised materials offered freely and openly for educators, students, and self-learners to use and reuse for teaching, learning and research.” OER include learning content; software tools to develop, use, and distribute content; and implementation resources such as open licenses. OER have great potential to reduce the cost and provide open access to a variety of learning activities. (Giving Knowledge for Free, 2007, pg. 10-12) UDL focused tools and materials are frequently OER.

Often, when people talk about OER, they are referring to open-source curriculum or courseware (OCW) provided through programs like the OpenCourseWare Consortium. The focus of these programs is “free and open digital publication of quality education materials.” (About the OCW Consortium, 2013) OCW initiatives are an excellent way of finding and sharing resources that meet the UDL guidelines. However, OCW tend to focus on the quality of the content and presentation without an equal concern for the accessibility of the medium or format. For example, the Support Centre for Open Resources in Education at Open University (SCORE) recently sponsored a survey on OER accessibility to investigate reports “that accessibility was either not explicitly addressed within project documents or was treated as an afterthought.” (Gruszczynska, 2012, pg.2)

There is evidence, however, that attitudes are shifting. OER Commons runs a Flexible Learning repository and an accessibility-minded OpenAuthor resource creation tool that supports accessible creation but does not recommend or mandate its usage in the interface. OpenAuthor was developed in coordination with FLOE which is an OER project specifically focused on providing tools that support the creation of flexible, accessible OER resources. OERPUB is a similar initiative supported by the Shuttleworth Foundation that is developing two OER authoring tools: one focused on converting existing materials and one focused on authoring new OER resources. The Accessibility Metadata Project is an effort to ensure Learning Resources Metadata initiatives include accessibility-minded tags. The OCW repository OpenLearn includes a link to its Web Accessibility at OpenLearn section from its homepage. OpenLearn claims to pay close attention to

the accessibility of its resources and platform, including providing textual descriptions or transcripts for 90% of its audio and video materials. (OpenLearn, 2013) The Open Courseware Consortium is involved in a project “to build an online community [focused on] facilitating the contribution and sharing of accessible technology information, expertise, and accessible online teaching and learning materials.” (Hanley, 2012) This OER and Accessibility site is not yet integrated within their main consortium site. These efforts, if sustained and aligned with some of Gruszczynska’s other OER accessibility recommendations, such as supporting diverse resources for the same content and using resource descriptions and metadata to promote and search by accessibility considerations, should significantly impact UDL adoption. (Gruszczynska and Hallam, 2012, pg. 3-4)

It is important to note, that even with the above mentioned advancements, OCW supports UDL primarily in the first and fourth step of the Instructional Process. OCW typically includes both learning goals and materials that can be adopted in whole or in part. They don’t typically account for learner variability, multiple assessment mechanisms, delivery strategies, evidence tracking or reflection tools. It is also short-sighted to underestimate the training and innovation needed to guarantee universally designed resources are common place in OCW and other shared repositories. The education community is struggling to ensure online documents are accessible. Tools that support the creation of universally designed audio and video content, interactive activities, and online assessments are rare and typically have steep learning curves. The aforementioned FLOE project may help change this; but the project’s tools are not widely integrated within solutions that educators use regularly and are too technical for many educators to implement independently. CAST’s own resources are similarly disconnected from educator’s everyday practices, which may be impeding adoption:

UDL Book Builder is a great tool to use, but I feel that it requires a great deal of skill to effectively use... To use this in a short time is quite unrealistic. (Jeff, 2012)

Furthermore, even technologies that support accessible content need to be evaluated closely to ensure they are truly usable. For example, an individual who is blind may need assistance accessing an audio description that is provided for a video because the media player it is embedded in is not accessible to all screen readers. One Canadian study from 2006 reviewed 18 eLearning features with blind and low-vision students. It found that none of the technologies were fully accessible to blind participants. (Fichten, Asuncion, Barile, Ferraro and Wolforth, 2009, pg. 550) Although alarming, these results are not surprising. In a 2000 article on accessibility in post-secondary education (Rowland), researchers at WebAIM argued to,

Think of accessibility as 6 pieces of a puzzle:

1. The knowledge and skills of the web designer (e.g., alt tags, captioning, adheres to all WAI guidelines)
2. Authoring Tools (a): Creators of markup language editors (e.g., Front Page, Dreamweaver)
3. Authoring Tools (b): Creators of course software (e.g., Web CT, Blackboard, Object servers)
4. User Agents (a): Creators of browsers (e.g., Internet Explorer, Netscape, AOL)
5. User Agents (b): Creators of assistive technology (e.g., JAWS, ZoomText)
6. Knowledge and skills of the user (e.g., can use all the features that are available)

There is no equivalent effort to the OCW movement to compile OER tools that create pedagogically sound, accessible content. The few lists that do exist, such as the Merlot Accessibility Tools page, are not comprehensive.

However, occurring parallel to recent initiatives to better support UDL within OCW, are two significant projects from CAST that target better support for the Instructional Planning process.

PowerUp What Works is a free program that helps schools “effectively implement and integrate technology to improve student outcomes, especially for students with disabilities.” (PowerUp What Works, 2013) It is a very recent beta program, which appears to have done a good job of integrating UDL instructional planning processes and Common Core Standards. It aligns standards-based instruction, Response to Intervention, UDL, and 21<sup>st</sup> Century Skills and it is supported by the U.S. Department of Education and CAST. The Common Core Standards are greatly increasing the potential of programs like PowerUp What Works by defining common learning outcomes for teachers. This consistency allows researchers and tool developers to provide concrete examples of appropriate teaching strategies, technologies and assessment methods. However, the focus on a specific standard makes it difficult to scale services to other educational environments. It will be interesting to see if teachers find enough value in the program to maintain sustained planning efforts within the PowerUp What Works platform, given that the software does not currently include a student interface.

UDL Exchange is another new tool (released February 2013) within CAST’s Learning Tools suite that is described as “a place to browse and build resources, lessons, and collections...[that] support instruction guided by the UDL principles.” (CAST, 2013, Welcome to the CAST UDL Exchange!) UDL Exchange is similar to existing OCW libraries, but places an emphasis on grouping resources that together provide multiple means of representation, expression and engagement. Similar to PowerUp What Works, UDL Exchange supports all aspects of the UDL Instructional Planning process. It differs from PowerUp What Works in that it does not attempt to provide example practices or technologies for meeting the common core standards. Instead, it supports the ability to recommend resources, which will allow the community to promote best practices overtime.

If the major barriers to implementing UDL are the lack of effective supports for planning, delivering and assessing technology-based lesson plans, and the lack of

appropriate, sharable resources and assessments, then practitioners should be optimistic that the above mentioned efforts will help alleviate some of their difficulties.

The next section outlines design ideas for a new approach that leverages existing solutions and ideas. It addresses barriers related to integrating designs within educators' existing workflows and provides a comprehensive guide through implementation. It also provides simple but effective scaffolds for accessible resource and activity creation.

## **Design Solution**

UDL is a detailed, multifaceted framework for designing curricula. For effective implementation, educators require in-depth knowledge of their subject area, the ability to create and assess appropriate learning materials and assessments, insight into what drives student engagement and techniques for reflecting on and evaluating their teaching practice. A wealth of resources and learning technologies exist to support these efforts, but finding, evaluating and synthesizing the aids is incredibly difficult. For widespread adoption of UDL to occur, educators need a cohesive toolset that guides them through the entire implementation process.

Although this toolset sounds complex, it largely exists today in leading LMS. By design, LMS provide technology stacks for integrating and delivering diverse learning materials. They are used extensively in both traditional (blended) and fully online classrooms at almost all grade levels. Designing a workflow and toolset for implementing UDL within a broader LMS design has the potential to shift responsibility for ensuring accessible materials, driving student engagement and evaluating effectiveness towards the technology solution. This will allow educators to focus more closely on course goals, learning materials and assessment practices. It also embeds UDL within technology that many educators already use and most institutions have already considered in their technology plans.

The close relationship between UDL and LMS is not a novel concept. CAST has a UDL resource for higher education that discusses the value,

The course website is central to the course in many ways. It serves as a frame that holds the syllabus, the assignments, the discussion groups, the projects, the class notes, the class videos, the PowerPoint slides for the lectures, and much more. For each week, there are also links to many websites that are presented as additional representations of the topic for the week, or as scaffolds and supports for student learning. (Rose, Harbour, Johnston, Daley and Abarbanell, 2006, pg.20).

The Maryland State Board of Education's framework for supporting UDL outlines the tie clearly,

I believe that "must-have" technologies include some kind of learning management system (LMS) to allow for an on-line community of learning for the students and classes...Having an LMS helps students (and teachers) keep assignments organized, get reminders, and check grades as well as have links to class notes, wikis and online content that their teacher can provide for access to multiple forms of learning. (Maryland State Board of Education, 2011, pg.18)

Furthermore, UDL practitioners have already created resources on using UDL within LMS that are actively used and shared. For example, California State University's Quality Online Learning and Technology (QOLT) initiative provides comprehensive resources for evaluating the design of online and blended courses that use LMS.

The UDL lesson planning guide described in this project demonstrates a design for integrating UDL curricula planning, delivery and assessment within an LMS. This planning guide does not outline a complete user interface for an LMS, nor does it detail designs for all possible learning technology integrations. Instead, it aims to provide enough context and examples for UDL practitioners to effectively evaluate the appropriateness of the features and workflows in supporting comprehensive UDL curricula creation. A particular focus is placed on supporting U.S. higher education instructors that teach blended courses (LMS and other learning technologies are used in conjunction with face-to-face activities and

instruction). (Alan and Seaman, 2009) Six interviews with post-secondary educators in North America who have experience applying UDL or Universal Instructional Design within online learning environments grounded this focus.

The design aims to be inclusive of and valuable to the broadest range of educators. However, since this guide is assumed to exist within an LMS and UDL research is U.S. focused, the primary user persona is U.S. post-secondary instructors in blended learning environments. The design assumes these users create their own lesson plans and activities. It also assumes that their plans and activities are guided by course objectives approved by their department and that they have a general knowledge of UDL and LMS. Six interviews with North American post-secondary instructors informed the design. Interviewees include tenured and non-tenured instructors from a range of disciplines, institution types and classroom environments. All interviewees use UDL or Universal Instructional Design (UID) and LMS in their teaching practices.

CAST's four step process for planning and delivering UDL curricula (Hall, Strangman and Meyer, 2003) is used to help frame the analysis of the design.

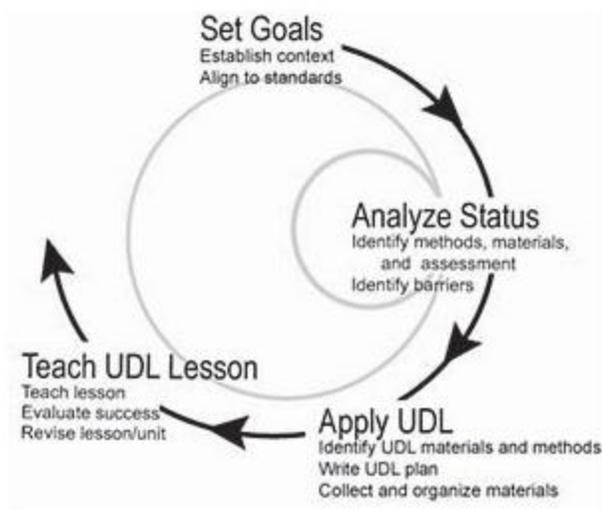


Figure 6: Curriculum planning and delivery process from CAST

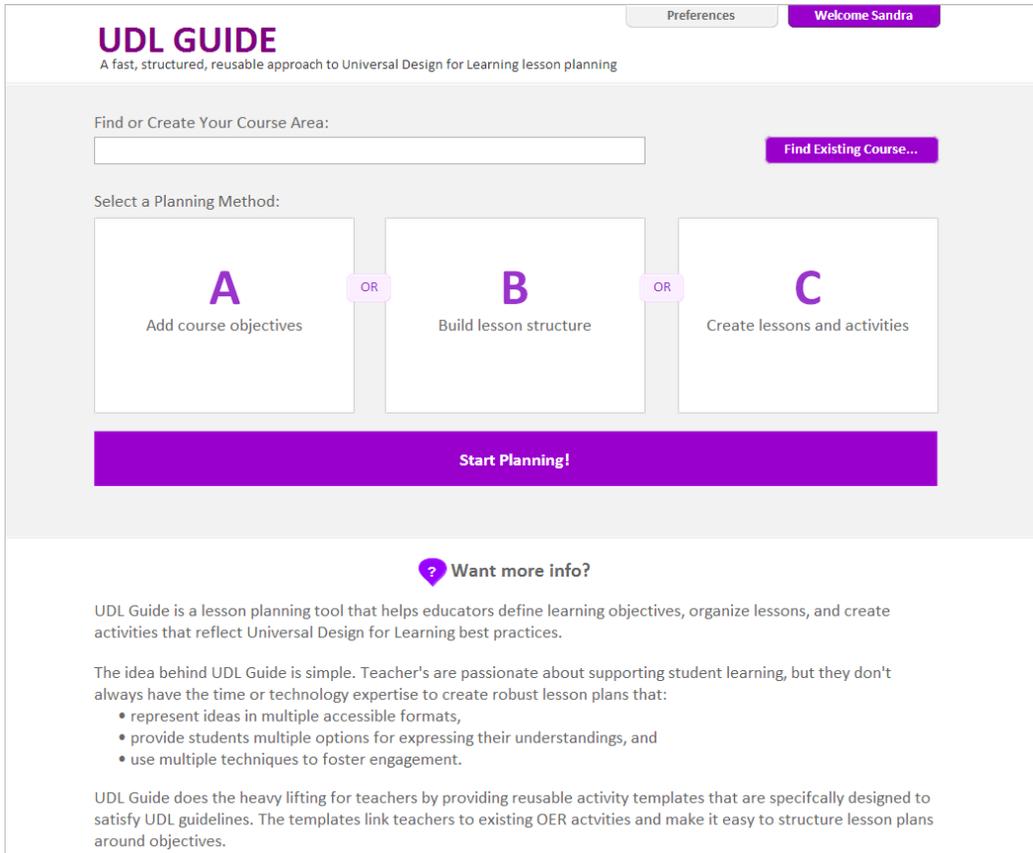
## How does the proposed design support goal setting?

Defining course goals, objectives or learning outcomes is the first step in many instructional design models, yet it is a secondary feature of most LMS (objectives are created in a separate tool or workflow; are managed at the activity or resource level; or must be added to a course overview or syllabus document as text or an attachment).

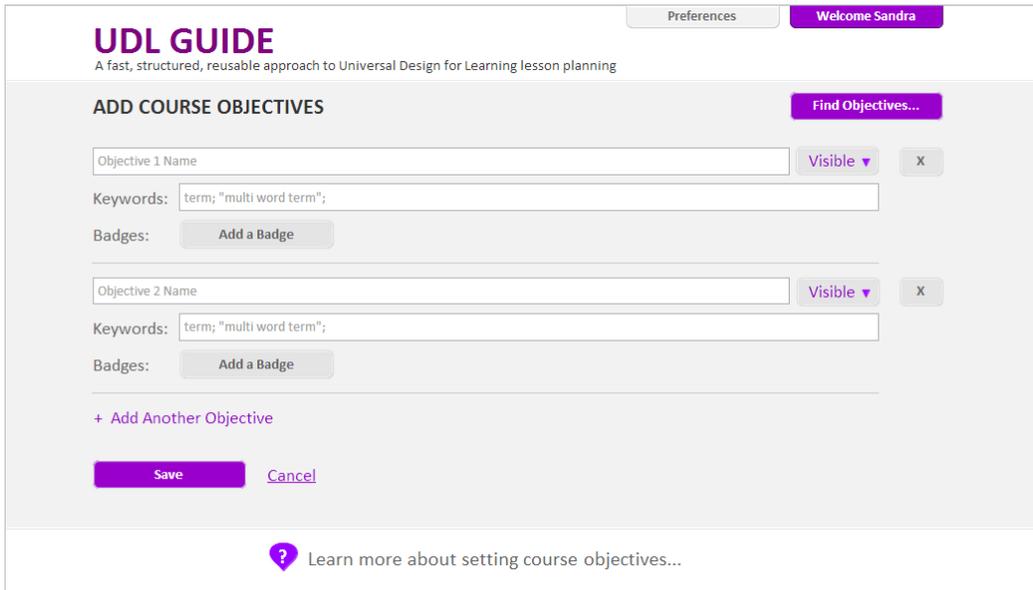
The accompanying screen shots show the entry page for the UDL lesson planning guide and the main page for defining course objectives. Notice how the workflow encourages users to define course objectives first, but is not prescriptive. This allows educators who already have defined objectives to skip to a more relevant step; although, the interface also supports quick entry, bulk upload and bulk import of existing objectives. For example, if curriculum goals are formally set by an institution or state standard, they can be input by someone other than the instructor and then imported into the course. If the prescribed goals do not align with the instructor's preferred method of communicating goals to students, the instructor can create related student-facing goals. Interviews with higher education instructors indicate some of the challenges faced in matching curriculum with course objectives,

We have the right to choose the particular curriculum material used in our courses, whether those courses are online or not...but topic wise we do have to cover...the common course outline...The specifics of how a course will be run are unique to instructors, but the major course outcomes, are common across all sections. (Participant 1)

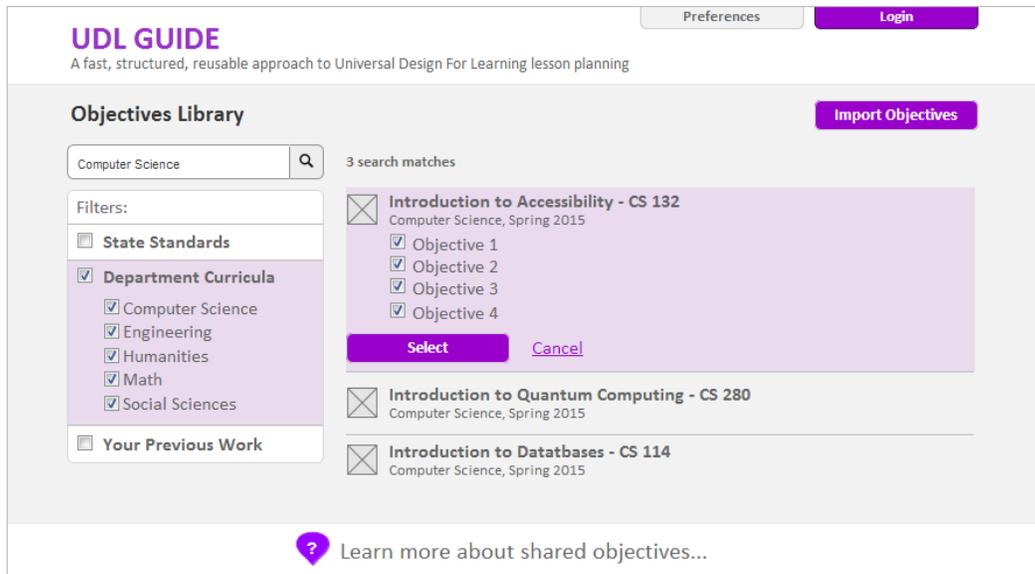
I take what we have in our common course outline and massage those a little bit to turn them into what I refer to as standards – here are the things we are going to be learning in this course...It's a standards based grading system. Their grade is based around demonstrations of whether they know these standards rather than behavior. (Participant 1)



**Figure 7: UDL Guide start screen**



**Figure 8: UDL Guide add course objectives screen**



**Figure 9: UDL Guide search existing objectives screen**

A key difference between this design and other tools, such as the UDL Goal Setter Tool, PowerUp What Works or UDL Exchange, is the focus on a holistic view of the course goals. Interviews with higher education instructors and a review of exemplary syllabi suggest that a clear overview of all course goals is important for subsequent planning and learning.

Obviously as I develop the course I try to keep those objectives in mind so that the assignments and the readings and the other materials reflect that. (Participant 2)

An [administrator] identifies a faculty member, or sometimes an outside person, to develop the curriculum... then they have to check in with our curriculum designers and developers to make sure you have the proper learning outcomes, they have to be written a certain way – the action verb and what not...if they want to collaborate on strategies and technologies, we do that as well. (Participant 3)

We talk substantially about the course objectives and how they relate to the rubrics and assignments. (Participant 4)

A centralized approach also makes it easier for instructors to envision how objectives will or could be used in other areas of the LMS to support UDL delivery or evaluation activities. For example, assessment and reporting interfaces for instructors and profile or achievement pages for students.

## How does the proposed design support the identification of appropriate methods, materials and assessments?

Whereas objectives and materials are specific to an individual course, the way lessons are structured or organized is often consistent across courses taught by the same instructor, or within a school or department with shared instructional practices. If you review popular courses in OCW or other course repositories, such as The Blackboard Exemplary Course Program, you notice three dominant organization models: by date (weekly units); by subject (grouped topics around a larger theme); and by activity type (separate categories for readings, discussions, tests, etc.).

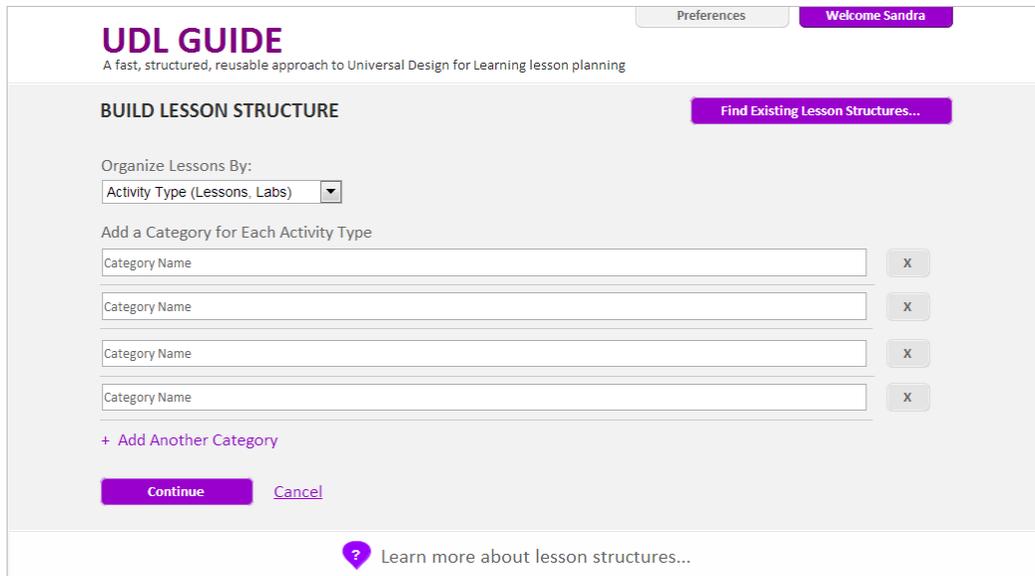
I have the overall course objectives and then I try to break that down into each module – there are objectives for each week – again to help focus what we are trying to learn for that particular week, for those particular assignments. (Participant 5)

The course I'm really excited about...is structured around five relevant social policies, or topics... Everything is written or other kinds of group or individual projects...that give them the opportunity to look stuff up on their own. (Participant 6)

By big topic area – in [course] we start off with a little bit of what I call introductory material that asks students to do some problem solving some talking about [the subject]. We get [assumptions] out on the table before we dig into what would traditionally be seen as the content. (Participant 1)

The screenshot shows the 'UDL GUIDE' interface for building lesson structures. It features a header with the title 'UDL GUIDE' and a subtitle 'A fast, structured, reusable approach to Universal Design for Learning lesson planning'. Below the header, there are two buttons: 'Preferences' and 'Welcome Sandra'. The main section is titled 'BUILD LESSON STRUCTURE' and contains a 'Find Existing Lesson Structures...' button. Underneath, there are form fields for 'Organize Lessons By:' (set to 'Date (Weekly, Bi-weekly)'), 'Create a New Unit Every:' (set to 'Week'), 'Beginning:' (with a date field 'DD / MM / YYYY' and a calendar icon), and 'Ending:' (with a date field 'DD / MM / YYYY' and a calendar icon). At the bottom of the form are 'Continue' and 'Cancel' buttons. A footer link with a question mark icon says 'Learn more about lesson structures...'.

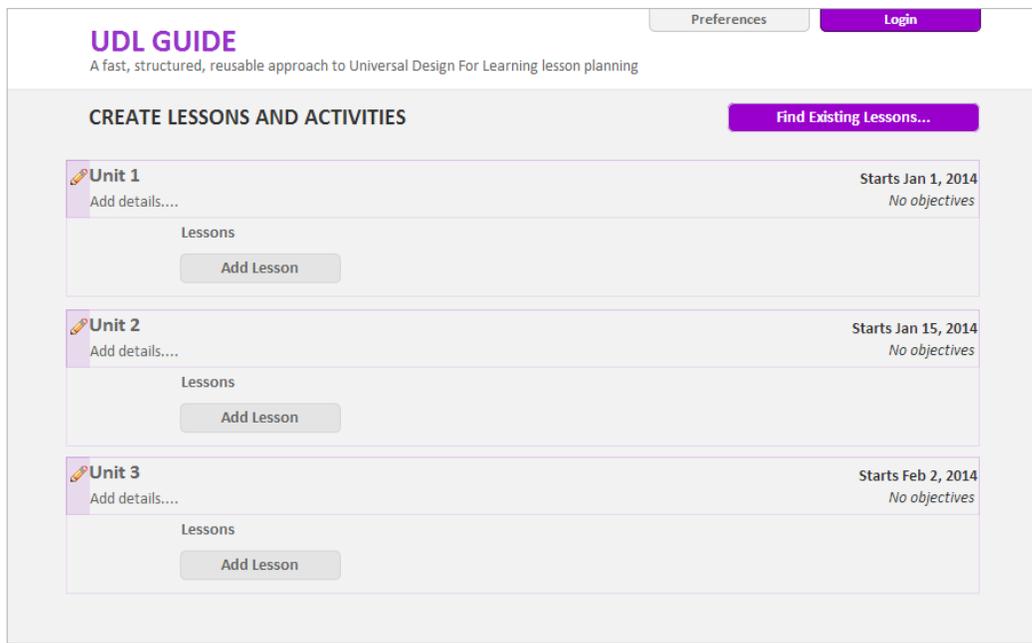
Figure 10: UDLGuide build lesson structure by date screen



**Figure 11: UDL Guide build lesson structure by activity type screen**

Using this knowledge of how educators typically structure lessons to help them stub out placeholders for their lesson plans is a simple scaffold with great impact. The similarity between the resulting lessons page and a course breakdown within a syllabus provides a sense of progress and structure early in the lesson creation workflow. It also acts as a checklist of completion as educators set up their course, showing which lesson designs are complete and whether objectives are balanced across units and lessons. Finally, in an integrated LMS design, the lesson structure itself could be visible to students and act as the main navigation hub through lessons and activities. Thus, by designing the lesson structure and lessons within the LMS, educators are also defining how students will navigate the materials.

I'm worried more about communicating what my students are to learn in pieces that are the right size for their learning and assessment. (Participant 1)



**Figure 12: UDL Guide create lessons and activities screen**

The lesson creation workflow shown in the accompanying screen shots and the following section illustrate the most significant difference between this design and other UDL tools. The premise of this part of the guide is that educators have an unfilled need for support selecting appropriate, inviting activities and technologies. Educators are specialists in their given subject areas, but may not have the knowledge, expertise, time or access to appropriate tools to create resources and assessment activities in a way that proactively ensures lessons provide multiple means of representation, engagement and expression. These principles are at the heart of UDL, but are elusive in practice,

As much as I would like to say [institution] wants universal instruction design, I'm not sure how many people outside [teaching and learning support group] would really know the term. It works really well if people developing the courses connect with us, but again there are no policies or procedures to make that happen. (Participant 3)

Like I said, I sort of held off on the captioning – I was planning to do that for the first semester because I had someone who needed captioning who was going to sign up but then she decided not to... So anything that was really required above and beyond the conversion of a book I would go through

disability services ... and then also work with the student and find out what was working for them and what isn't. (Participant 5)

There is an option that not many students take me up on...if your scores are still pretty low you can establish a remediation plan and a reassessment plan. [Students] are not as proactive on that as I would like them to be. For me that's an area of professional development opportunity to try and think about how to structure courses to encourage more of that. (Participant 1)

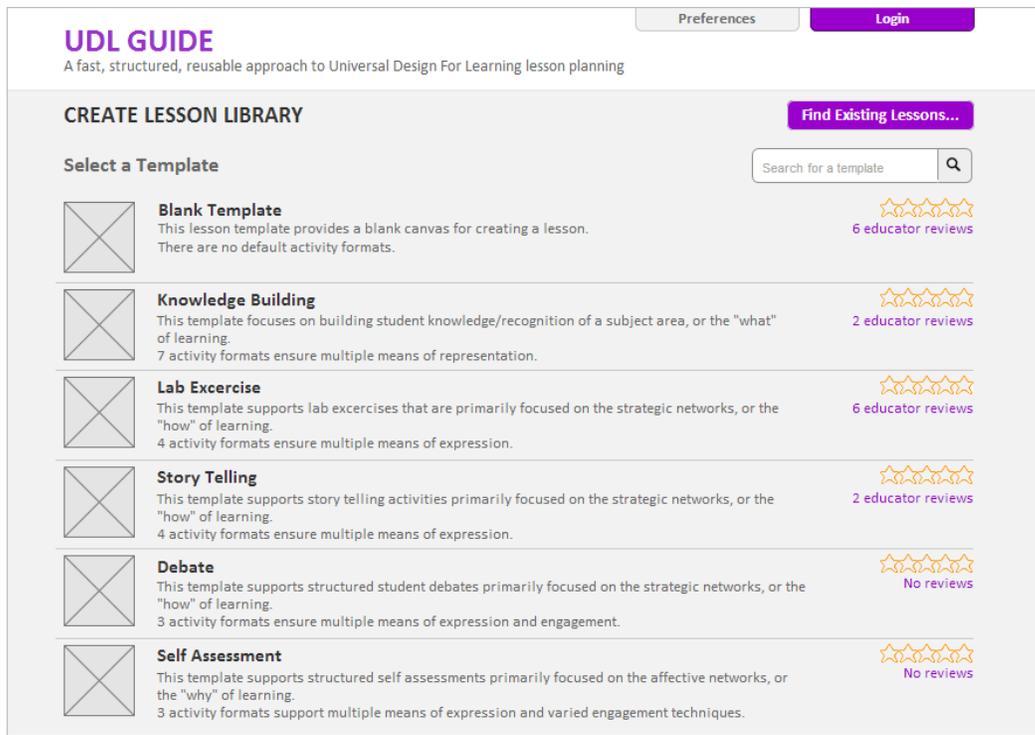


Figure 13: UDL Guide select a template page

Most examples of UDL in action focus on a single course, lesson or objective and how specific content was adapted to meet the UDL guidelines. Very few examples focus on strategies for implementing lessons that are effective and reusable across knowledge domains. Yet, a review of popular web content creation tools outside of education suggests that this approach is successful. The open source solutions WordPress, jQuery and Twitter Bootstrap all recognize that users are primarily concerned with content. They don't necessarily have the same knowledge of, or focus on, the technologies needed to deliver the content or make it inviting. In response, these solutions provide templates and scaffolds to ease project creation. The user community can then adapt and build out the resources

as needed. In an article on Twitter Bootstrap for Linux Journal, Reuven Lerner (2012) describes the benefits of a design framework as follows,

The secret behind such frameworks is that by buying into their predefined CSS classes, you give up some of the freedom you had with pure CSS. You agree to use their classes and to use their HTML structure in some cases. This is generally a worthwhile trade-off, in that your code and CSS end up being much shorter and more legible. You can concentrate on your domain of expertise, namely software development, rather than tweaking the CSS to look just right. And, because these frameworks constantly are evolving to support designers and developers, each upgrade supports more browsers, more optimizations and more CSS classes that you can use to integrate into your work. (Lerner, 2012)

Examples also exist within OCW, such as OpenAuthor and Connexions; inclusive OER, such as FLOE and TILE; and other eLearning solutions such as SoftChalk and OpenTapestry. All of these tools provide features for creating lessons that align with UDL, but they are not comprehensive and are not sufficiently embedded within educators' delivery practices. For example, OpenAuthor and Connexions are largely focused on learning material; FLOE is focused on developer toolkits; and neither SoftChalk nor OpenTapestry provide scaffolds on how to effectively combine resources to ensure accessibility or alignment with UDL guidelines. Finally, all of these tools require integration with a course website or LMS to be effectively delivered to students.

The templates in this guide provide scaffolds for targeting the three networks of learning defined in UDL. (Rose and Meyer, Chapter 4) Each template suggests a variety of learning tools that when combined provide good coverage of the nine UDL guidelines. The template list and corresponding learning technologies shown are not exhaustive; they could be refined over time by educators and the LMS provider as best practices emerge.

Both the templates and the resources created using the templates could be shared within the LMS through a local repository and to external OER repositories. As a result, the effectiveness of the mediums and teaching methods could be evaluated over multiple courses and organizations utilizing the same templates. This would

help inform decisions during planning and make it easier to quantify the effectiveness of different methodologies. It also aligns technology supports with educators' broader interest in peer collaboration. For example, when asked how UDL could be promoted more effectively, one interviewee responded,

Getting the instructors who have courses that use these principles showcasing not just what they've done, but how they did it. (Participant 3)

The same interviewee also clarified,

I'm big with open educational resources so the whole idea of producing and sharing stuff is wonderful....we don't have multimedia production in house...so we do rely a lot on sharing and reusing. (Participant 3)

### **How does the proposed design support resource organization and authoring?**

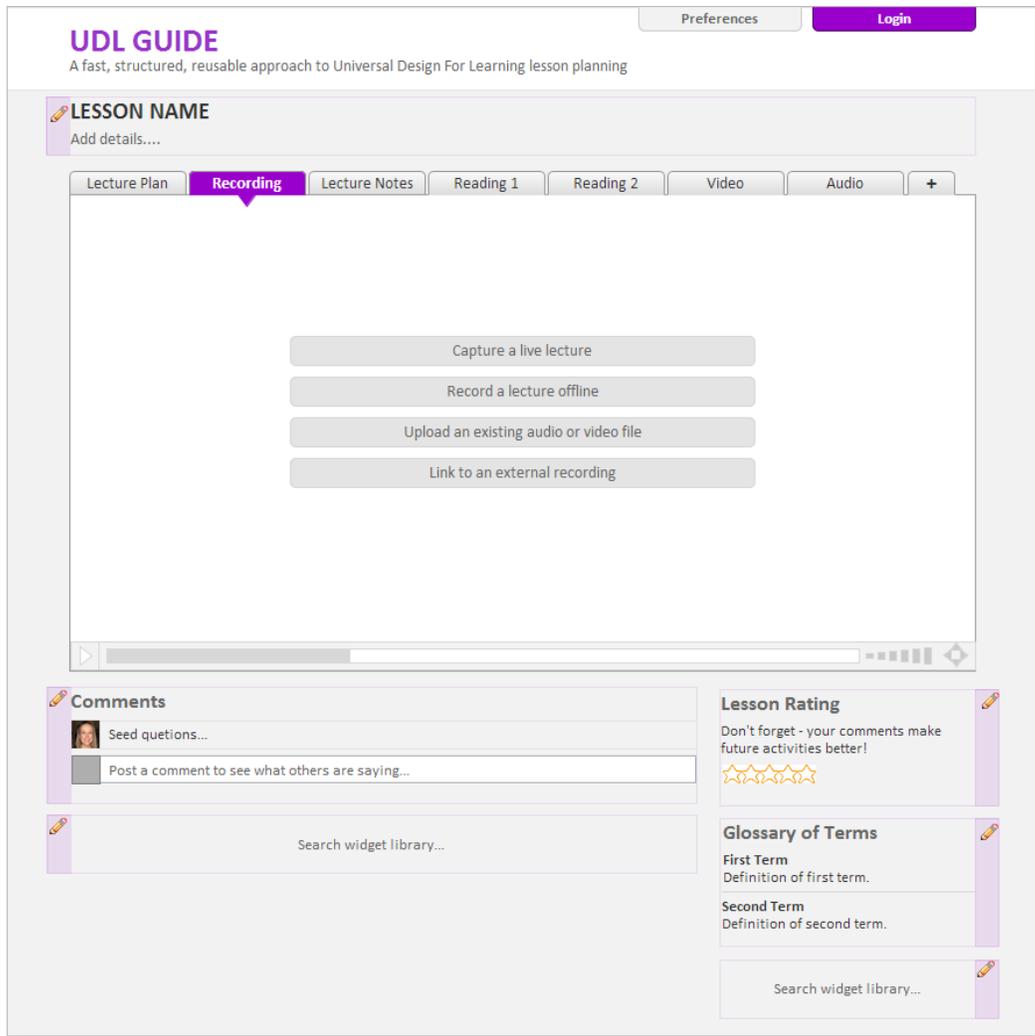
A template based approach to resource and activity creation assumes the LMS supports content authored in a variety of ways. This might include native LMS features (built-in quiz, discussion, wiki, blog, document editing and assignment submission tools), third-party integrations (including IMS Global Learning Tools Interoperability (LTI) tool providers) and direct links or references to external technologies (including OER) that provide embed code or use file formats the LMS can display. Most LMS already employ a variety of methods for handling such content (APIs, iFramed content, etc.) and therefore the design is not as far-reaching as it might initially appear. The main changes the design proposes are strong ties to overarching course objectives; scaffolded disclosure of resource creation tools (through the templates); preferential treatment of activities that align with ATAG, ARIA and WCAG 2.0; the ability to tag and share effective practices; and lesson-level supports to help guide and engage students.

The accompanying lesson template includes activities targeted at the recognition networks of learning. According to UDL research, these networks constitute the “what” of learning, they “enable us to identify and understand information, ideas, and concepts.” (CAST, 2013, What is UDL). This template could be used to introduce basic concepts and ideas at the start of each unit, with subsequent

lessons focused on the other two sets of learning networks: strategic (how we organize and express our ideas) and affective (why we get engaged in and motivated by learning). (CAST, 2013, What is UDL) It was inspired by a CAST article, *Universal Design For Learning in Postsecondary Education* (Rose, Harbour, Johnston, Daley and Abarbanell, 2006), which outlines a number of UDL techniques for a blended learning classroom. In particular the article discusses the benefits of providing a lecture recording for offline review, student note sharing, and providing both a theory-oriented and illustration-oriented reading option. It also includes a lecture plan, video resource and audio resource. The last tab in each template is a blank resource page that allows educators to upload any supported resource or browse a full list of integrated tools. This, combined with the ability to delete undesired tabs, ensures the templates provide guidance and inspiration without being prescriptive.

[Student] really like that I am able to do analogies to make it relevant. If they don't understand something rewording it, rephrasing it, giving them examples of why it is that way. More real-life examples, because sometimes they aren't making that connection between [education] and their real-life jobs. (Participant 3)

The class is somewhat text heavy, there are occasional videos interspersed, some of the case studies that I've found have been multimedia based... I'll do anything from drawing on the white board to doing a quick captivate video. I try to give them different access points for the most difficult stuff over several weeks. I'll point them to resources out there on the web in addition what I'm willing to build in. (Participant 4)



**Figure 14: UDL Guide sample lesson page**

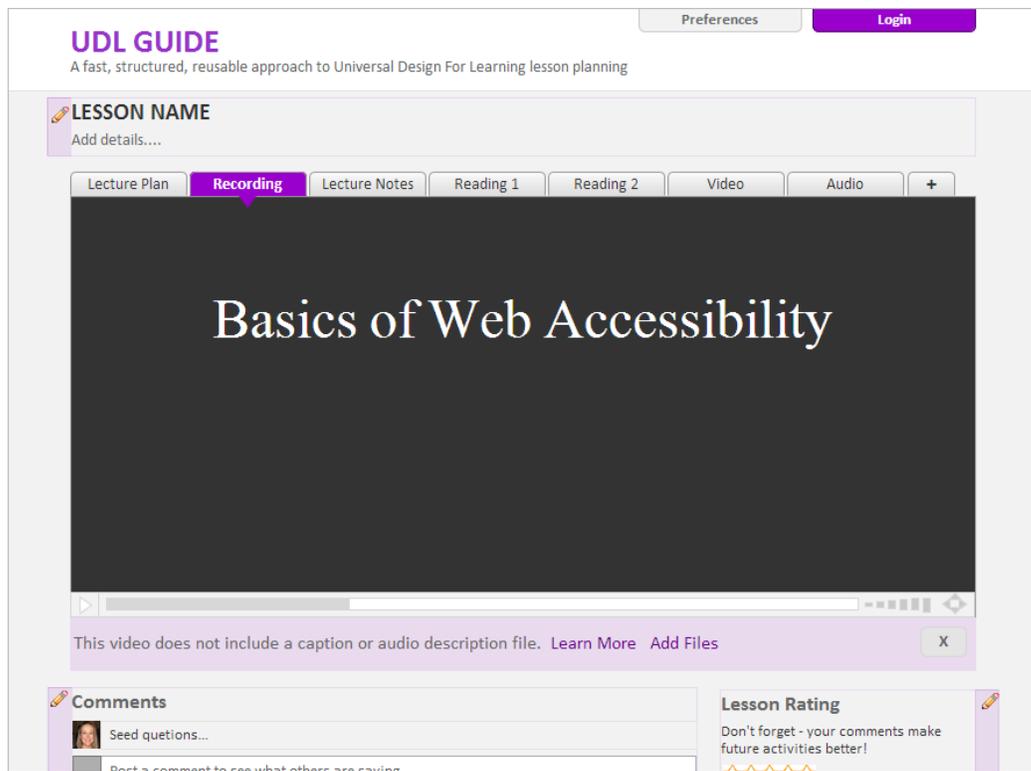
Each tab contains a number of recommended authoring tools. When deciding which tools to integrate, the LMS provider should consider how the tools support the UDL guidelines. A particular focus should be placed on the accessibility of the tools and resulting content. Most LMS providers are familiar with assessing the accessibility of technologies, either through internal programs, close relationships with client experts, or consultancy arrangements.

Thanks to the hard work of various LMS accessibility working groups and their open-source and vendor developer partners, many LMS vendors have begun to understand the need for universal usability of their tools. (Rangin, 2013)

When asked if and how accessibility is considered in the selection of software to use in the classroom, one interviewee implied that accessibility is assumed in the LMS, but questioned in other learning technologies,

Most of the technology I use is [the LMS]... I have students create video for the introduction and post it on [third-party tool]. I probably haven't checked how easy that would be with a screen reader... [Another third party tool] I'm not if that is accessible. I think they mention that it might not be fully accessible. You know that is an issue. I guess it hasn't come up too much. I haven't used too much extraneous technology and I kind of deal with it on an individual to individual basis. (Participant 5)

An integrated UDL workflow within LMS would help accessibility advocates further promote the importance of accessible user experiences, and extend their influence over third-party integrations. For example, the ability to tag and share comments on the effectiveness of tools would allow educators to share authoring best practices, accommodation notes and work-arounds. This could include information on compliance with Section 508, WCAG 2.0 and ARIA. The UDL guide itself should follow ATAG guidelines related to checking and prompting for accessible content during the authoring processes. Such efforts would greatly simplify the steps involved in meeting the more technical UDL guidelines, such as customizing the display of information, alternatives for visual and auditory content, alternatives for physical activities, accessible navigation methods and assistive technology interoperability.



**Figure 15: UDL Guide add caption and audio description prompt**

In addition to encouraging multiple resources within lessons, the UDL guide should promote the consistent use of metadata and student supports across lessons. For example, educators should be able to provide a description, private notes, objectives and assessment methods. It would also be valuable to integrate UDL features that apply across lessons, such as comments to foster engagement, a glossary of terms to aid comprehension and lesson rating to promote reflection.

Any time my students are [demonstrating knowledge] it is on one or more standards... The standards will be at the top of the [activity], just a copy and paste of the standard from the syllabus so we are always using the same language and they can identify what's the point of what we're working on here. (Participant 1)

You know in the moment whether they're getting it or not, but you have to know why they're not getting it. That's why I do like using clickers or understoodit.com when possible... There's nothing worse than going through a two hour course with however many activities in it and realizing no one understood anything you said or did. (Participant 3)

UDL GUIDE  
A fast, structured, reusable approach to Universal Design For Learning lesson planning

Preferences Login

LESSON NAME

Description:

Private Notes:

Assessment Methods:

Add Rubric Add Grade Item

Objectives:

Add Objectives

Save Cancel

Lecture Plan Recording Lecture Notes Reading 1 Reading 2 Video Audio +

Figure 16: UDL Guide lesson details expanded

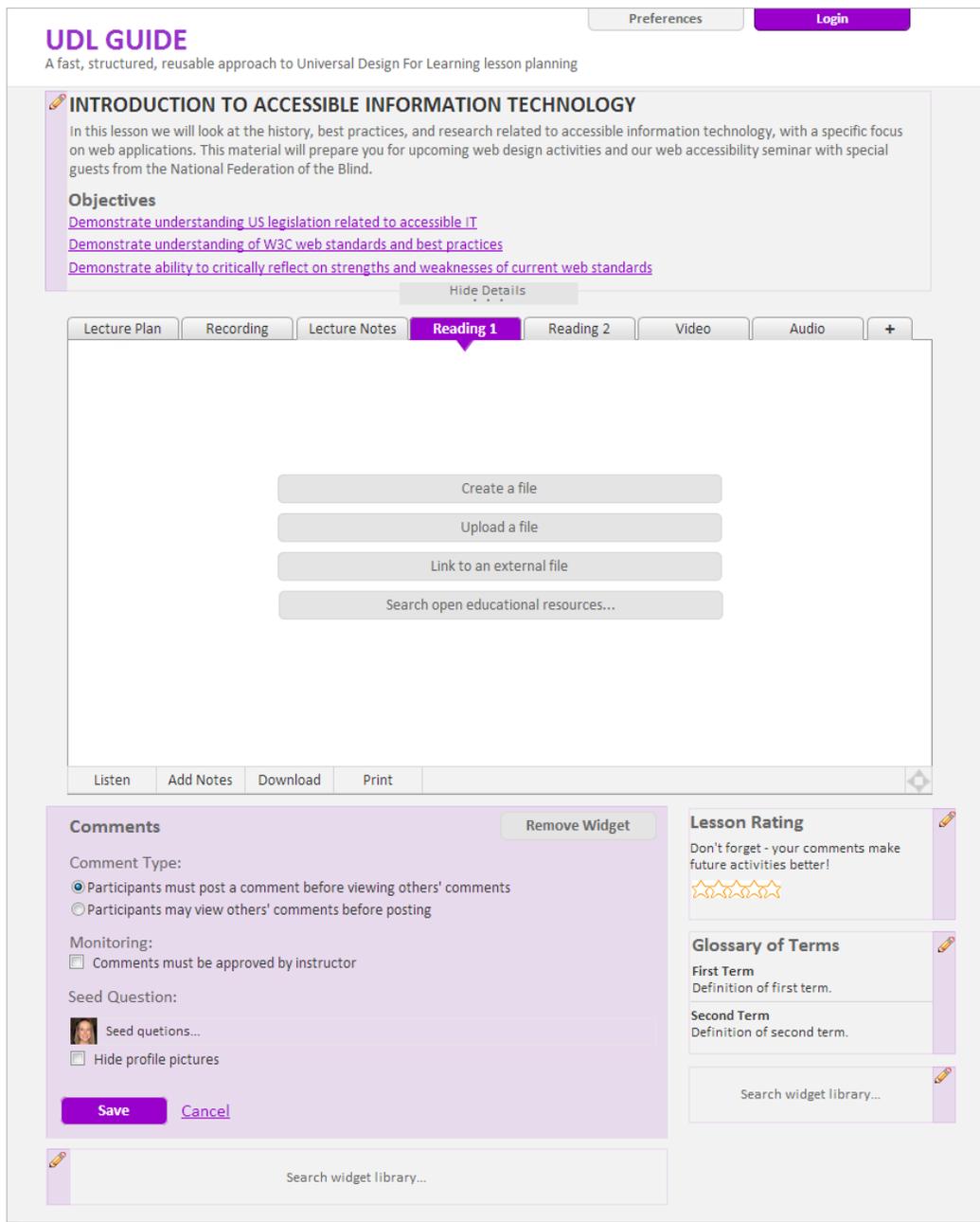


Figure 17: UDL Guide comments widget for a lesson expanded

## How does the proposed design support lesson delivery and evaluation?

Although this design prototype focuses on a workflow and toolset for creating UDL curricula, inherent to the design is the assumption that the guide resides within and closely integrates with the lesson delivery, assessment and evaluation interfaces (other LMS features). The guide is also designed to showcase how the

lesson creation interface could closely mirror and support the student-facing lesson delivery interface. This type of edit-in-place interaction design makes it easy to conceptualize how other users will view and interact with the resources. As Tidwell describes in the popular interaction design reference book *Designing Interfaces: Patterns for Effective Interaction Design* (2006):

Making the user go somewhere else -- a place far away spatially, or disconnected from the original text, in another window -- usually isn't a good idea. The user may not find the editor, for one thing. It also takes time to switch one's attention from one place to another, and the perceived complexity of the interface is increased.

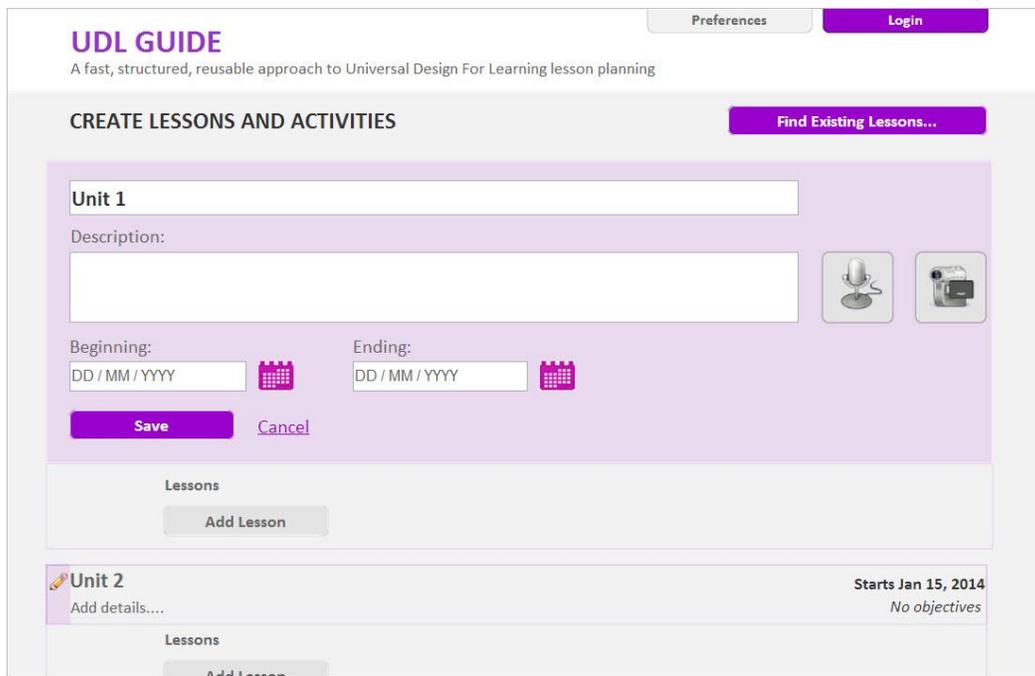


Figure 18: UDL Guide unit details expanded

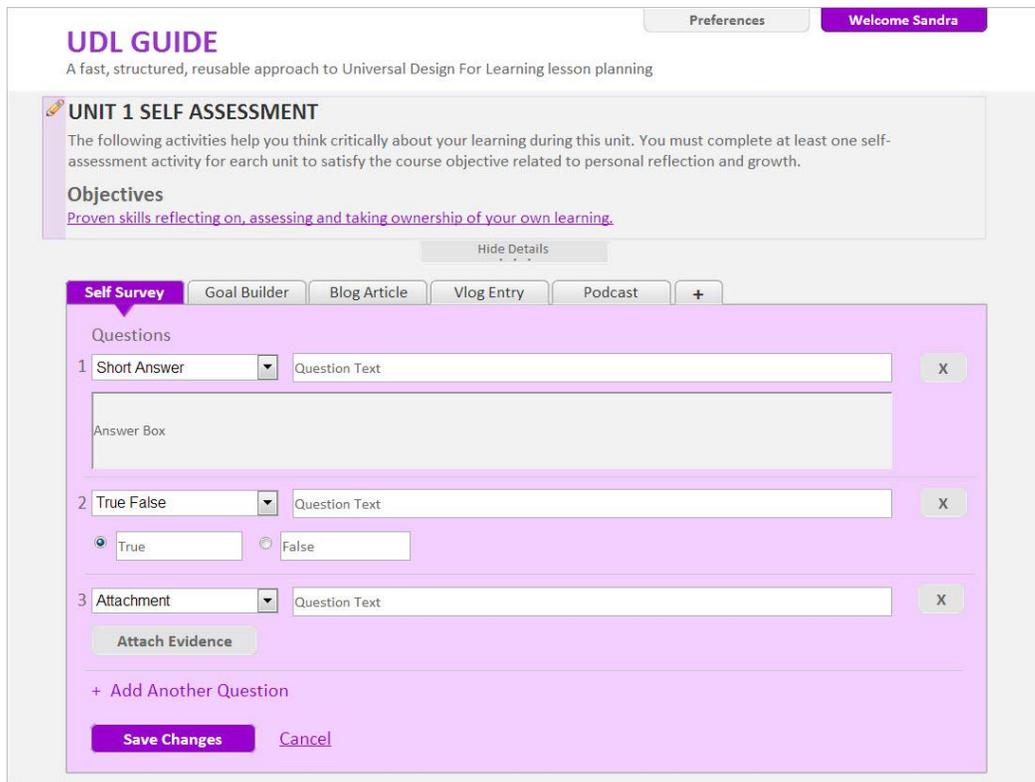


Figure 19: UDL Guide edit self-survey activity in-place

This approach also benefits the learner since it encourages educators to provide learning goals, lesson descriptions, resources and assessments in a single, organized location that can be viewed both within and outside the classroom. It also allows educators to share information about in-class activities with parents and guardians where applicable.

This workflow design covers the creation of assessment criteria. It does not provide detailed designs for how an LMS might track or display those assessments, or how educators or administrators might evaluate the effectiveness of the curricula. Reviewing some of the features of the workflow, however, can provide some insight into what evaluation models could be designed.

By allowing administrators to pre-populate the workflow with applicable objectives, this design supports performance tracking at the course level or higher. For example, the LMS provider could use this information to design reports that show how a particular educator covered the state standards or how a set of courses

cover all of the learning objectives required for a particular accreditation. Reports could also be designed to inform students of previously acquired skills and recommend future courses based on their strengths or growth opportunities.

When we get to this point of getting Analytics, getting some feedback based on my actions of connecting the learning objective, I'm hopeful [that adding objectives to each activity will be helpful]. But right now there's no real feedback, there's nothing that I'm – you know, it's that classic moment of the instructor's time making it easier for a student to consume the course, but not getting any feedback on that ease. (Participant 4)

By encouraging educators to record learning objectives in the same tool that students use to interact with course materials, the workflow supports student-centered progress tracking features. The LMS could, for example, prominently display the badges or objectives students have earned. This could encourage engagement as well as provide feedback on the type of assessment activities the student is most comfortable with. Students might then be better able to understand their learning preferences. Such aids could also include progress bars, calendars, or reminders to help students pace and track their progress.

The screenshot shows a course overview page for "INTRODUCTION TO PALEONTOLOGY". At the top right, there are buttons for "Preferences" and "Welcome Sandra". Below the course title, there is a photo of a dinosaur skeleton and a profile for the instructor, Sandra Earl. The "Course Overview" tab is selected, showing a "Course Description" and a list of "Course Objectives". Three objectives are marked with a purple checkmark, indicating they have been completed or achieved.

**INTRODUCTION TO PALEONTOLOGY**

Preferences Welcome Sandra

Taught by: **Sandra Earl**  
Sandra has taught as an adjunct instructor for the past seven years. She has 15 years experience as a paleontologist in North America, Europe and Asia.  
Email: [searl@someuniversity.edu](mailto:searl@someuniversity.edu)

Photo credit: blgrssby via Flickr

Course Overview Lessons

Course Description:  
**Introduction to paleontology provides a facinating overview of the study of fossils and it has influenced science, history and daily life.**

Course Objectives:

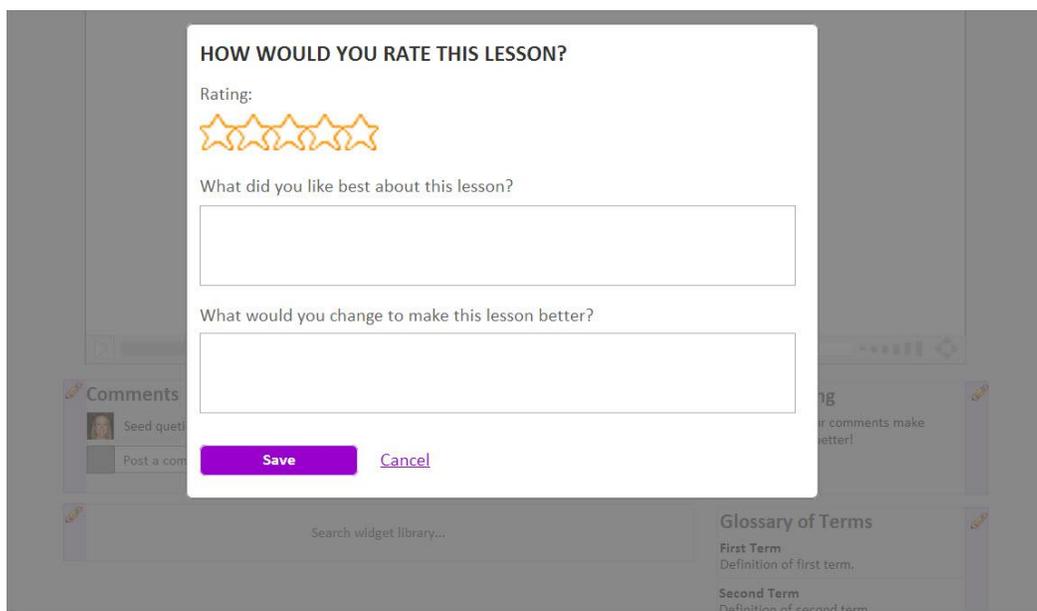
- Students can reconstruct the biological traits of extinct organisms.** ✓
- Students can interpret the modes of life of fossil organisms.** ✓
- Students can evaluate the accuracy of the portrayal of ancient organisms in the movies.** ✓
- Students can evaluate the evidence for an interpretation of a new fossil.
- Students can reconstruct the taphonomic history of a given fossil or fossil assemblage.
- Students can use the principles of taphonomy to construct an environment based on preserved fauna.
- Students can evaluate the adequacy of the fossil record for tackling a particular question.

Figure 20: UDL Guide example objectives on a course overview page

Including features where students can provide feedback through a quick rating, survey or opinion poll, allows educators to continuously monitor the effectiveness of different lesson strategies. This could highlight opportunities to circle back or spend more time on problem areas. Likewise, the comments area should provide insight into student engagement with lessons and peer interactions.

I think the feedback is important. I think that if the topic area is of interest I think that helps keep people, students, interested in it. (Participant 5)

[Determining if students need follow-up] is pretty low tech. It's usually based on students saying "I don't understand" during those small group discussions. I work pretty hard to make [group discussions] as low, as not as intimidating as possible... The anonymous survey is still sitting their sort of as a final catch. (Participant 4)



The image shows a screenshot of a lesson rating dialog box. The dialog is titled "HOW WOULD YOU RATE THIS LESSON?". It features a "Rating:" section with five orange stars. Below the stars are two text input fields: "What did you like best about this lesson?" and "What would you change to make this lesson better?". At the bottom of the dialog are two buttons: a purple "Save" button and a "Cancel" button. The background is a blurred view of a lesson page with a "Comments" section and a "Glossary of Terms" section.

**Figure 21: UDL Guide lesson rating dialog**

Finally, by allowing educators to reuse and share objectives and lessons, the guide makes it easy for educators to tweak designs in future course offerings. As the guide continues to capture data it could evolve into a comprehensive tool to share best practices with and learn from colleagues.

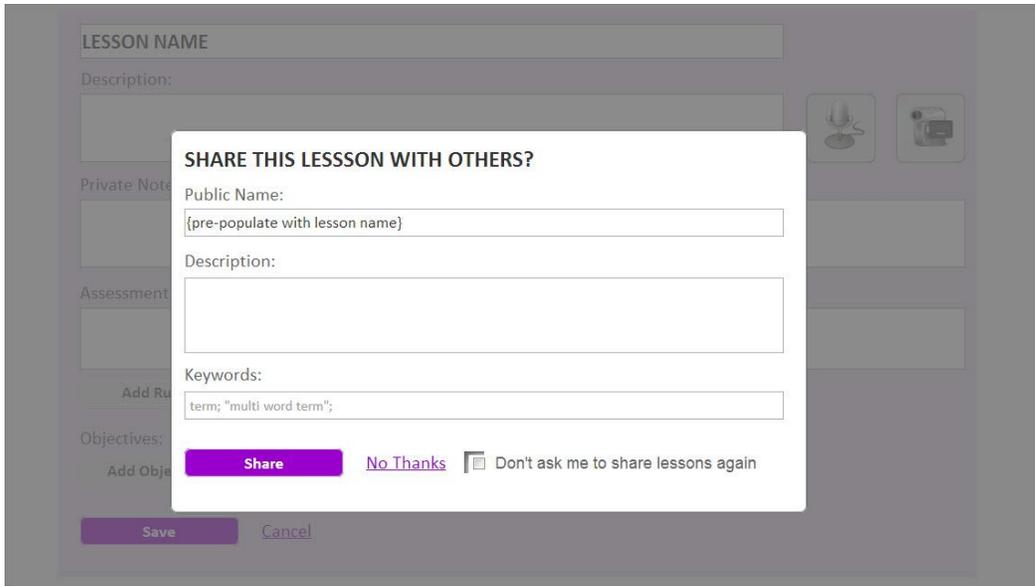


Figure 22: UDL Guide share lesson dialog

## Conclusions

As blended and online learning becomes increasingly prevalent in higher education, more institutions and individual educators are adopting LMS to help manage and structure their learning programs. At the same time, LMS are improving the accessibility of their platforms and integrating with more third-party tools. OCW and OER repositories are undergoing similar growth and maturing their inclusion efforts. User interface designers and educators need to work together to ensure that student success is at the heart of these changes.

A UDL guide within an LMS that shares resources with OCW and OER could provide the ideal technology scaffolds to take educators through the entire goal setting, lesson planning, activity creation, lesson delivery and evaluation process – enabling the kinds of inclusive learning opportunities that educators, administrators and government officials who advocate for UDL dream of. Since a guide supports a complex activity through a single interface design by breaking work into small tasks that do not have a rigid order, it can reduce the amount of time spent learning, managing and teaching others about the technology. In particular, a UDL guide could help educators focus their efforts related to setting

and aligning appropriate goals; planning lessons that are flexible and inclusive; finding, creating and sharing effective learning activities; delivering engaging lessons; and evaluating whether the curriculum is effective. This would free up time for student support and engagement activities.

Community-driven lesson templates that focus on sharing inclusive and engaging teaching methodologies and activity mediums could help bridge the gap between current ideals regarding the UDL guidelines and principles and effective application. By allowing best practices to be realized across subject matters, teaching levels and organization types, the templates should stimulate innovation and embolden pressure on technology providers to offer more accessible features. At the same time, if enough educators use similar templates and practices with positive outcomes, a more rigorous body of evidence supporting UDL could emerge.

Combined, the guide and templates showcase how a thoughtfully designed learning tool can foster inclusive practices that are driven by educational communities. Furthermore, they showcase how the learning tool itself can be universally designed to support educators with different objectives, learning activities, teaching methodologies and evaluation practices, as well as different needs and preferences related to the tool.

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