

Design for All



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GUEST EDITOR:



Dr. Lee Christopher

I have a Ph.D. in Education with a specialization in Instructional Design, a Masters of Fine Arts in Writing and Poetics (MFA) and a Masters in Education (M.Ed). My research interests center on Universal Design for Learning. I love to write and teach. Whenever teaching I learn a little more about what Universal Design for Learning means and how much students enthusiastically embrace its principles. My philosophy of education centers around the learner. As an instructor, I am much like a coach and so, strive to listen to what students are saying and then facilitate their learning as much as possible. As an administrator, I listen to students, staff and everyone I work with to learn more about Universal Design and how I can be a part of helping to make life better for all. I love technology and the doors it opens for everyone. I love hiking, reading, writing, weight lifting, and most of all, being with my family.

Editorial

Lee Christopher

Inclusive Universal Design for Learning

What is Universal Design for Learning (UDL)? What is Universal Design of Instruction (UDI)? What is Universal Instructional Design (UID)? What is Universal Design (UD)? What is Digital Accessibility (DA)? What is Digital Inclusion (DI)?

Educators love acronyms. Maybe we all secretly love acronyms. Acronyms such as UDL, UDI, UID, UD, DA and DI give us way to organize our thoughts and ideas, a place to categorize what we're thinking or advocating quickly and efficiently. However, we must always keep in the forefront of our minds and actions what these acronyms truly and fully mean. Ed Espe Brown reminds us when cutting a carrot, "Not just cutting the carrot took attention, but picking up the knife, putting the knife down, wiping the knife, cleaning the knife, sharpening the knife, storing the knife,"—all require our attention.

In this issue of *Design for All* you will learn about these terms and what they mean.

In "Under the Mask: Universal Design for Learning as Ableist Pedagogy", Grewe and Christopher point out that UDL can mask the unintentional ability to perform acts of ableism.

Mann, McGrew, and Knowles show us how Problem Based Learning can be brought to students through Universal Design for Instruction.

Cara Idol in “Digital Accessibility as Curriculum” demonstrates that students with accessibility training can get better jobs.

Taylor McGrew gives us guides to Universal Design of Instruction (UDI) with inclusion being paramount.

Cara Idol (lead writer and designer), Taylor McGrew, Soma Ghosh, Stephen Knowles and Lee Christopher give “Five UDL Strategies someone can implement today!”

Lastly in this issue, Ahmerd, Simpson, Smith, and Sundby give real substance to this issue by sharing with us the experiences of school during COVID for two parents with disabilities.

One of the most important points that the articles in this journal remind us is that we must recognize that though we have good intentions, we often miss the goal of reaching everyone. We need to engage in and include the full spectrum of identities, strengths, weaknesses, perspectives, and values. We need to engage in the whole wonderful range of human diversity.

Whenever we begin a new project whether it’s designing a new building, or a new bathroom, or a new classroom or a new course for teachers, let’s be sure to really be inclusive and always have someone on the team who is not like us, who doesn’t look like us, talk like us, act like us, someone who is a beginner and who has a beginner’s mind about what we’re about to create. If we make this commitment, we just might come out with a project that reaches everyone, one that is truly inclusive and accessible.



Dr. Brian Grewe

Brian Grewe (Ph.D., University of Denver) is the Director of Disability Access Services at Arapahoe Community College. His professional work centers disability justice, access and equity and student success through the lens of Communication Ethics. His research interests focus at the intersections of disability, education and ethics with a lens on discourses of disability. Brian has served in different capacities as an adjunct instructor and visiting teaching assistant professor, teaching courses on disability, relational communication, and research methods.



Dr. Lee Christopher

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Under the Mask: Universal Design for Learning as Ableist Pedagogy

Brian Grewe

Lee Christopher

Introduction

Within the United States, more than one in six people have been identified as having a disability, while one in ten are reported to have a severe physical disability (Brault, 2010). Additionally, in higher education between 12 and 15 percent of people identify as having a disability (NCES, 2011), with three to five percent of people identifying with campus disability services (AHEAD, 2016). Since the 2007-2008 academic year, both institutions of higher education and disability services offices have reported growth in their disabled student population (AHEAD, 2016; NCES, 2011).

Alongside this growth, institutions of higher education have furthered their commitment to civil rights, specifically those that involve people with disabilities has also increased in understanding and action. Many institutions promote inclusive learning environments by committing to inclusive excellence standards (Burghstahler, 2010). Within this movement, a call for accessibility and Universal Design for Learning (UDL) has been adopted to reach more/all students (Burghstahler, 2010).

The implementation of accessibility and UDL within higher education has mostly been reactionary. In a recent InsideHigherEd.com article, a spokesperson from the Department of Justice, the investigation arm of the Office of Civil Rights

reported that as of August 7th, 2017 there were 556 open cases (McKenzie, 2018). Additionally, in November of 2018, an additional 50 colleges had lawsuits opened against them for failure to comply with web accessibility compliance guidelines (McKenzie, 2018). In addition to these open cases, the Office of Civil Rights reports that they receive thousands of complaints a year on people alleging their civil rights as they pertain to disability are being infringed upon. This is a steep rise in risk for institutions of higher education to take on without a plan to ensure some level of protection. Most schools come to the same conclusion that if they meet 508 compliance and implement UDL practices, they are free from litigation. Feingold argues that instead of focusing on the ramifications of the potential for litigation, collaborating to reach compliance through proper planning, monitoring and enforcement would provide a sustainable model for inclusiveness. This belief, whether true or false, we argue perpetuates ableism within higher education under the guise of “reaching all students.”

Literature Review

Universal Design for Learning was first adapted from the work of Robert Mace, an architect from 1970s who believed in designing physical spaces to be barrier free was later adopted into education as a pedagogical framework and design to create inclusive, barrier free, learning environments. The premise of UDL is based on three primary tenets. Each tenet provides variety and choice for students.

The first principle is multiple means of representation of course/class learning materials. This manifests in producing information within multiple media including alternative

representations of auditory and visual objects; access to language and symbols for diverse learning groups; and summarization of complex ideas into manageable sizes for various audience members. In practice, this takes the form of providing captions and descriptive text to multimedia objects. In some spaces, this also manifests as term glossaries and video shorts that re-explain/simply explain course terminology and jargon (Burghstahler, 2010; CAST, 2014; Meyer, A., Rose, D., & Gordon, D., 2014).

The second principle of UDL is multiple means of action and expression (assessment). This manifests as the ability to assess student learning through multiple modes. Students are not limited to one type of assessment, and can display learning through a variety of means. Additionally, students can utilize various forms of technology for construction and composition; build fluency in ideas and abilities through various levels of support and set goals that are reachable, manageable and appropriate for the course content (meeting students where they are).

The final principle of UDL is multiple means of engagement. Research supports that students who are engaged or invested in the material, the institution or in the course content report higher levels of learning (Burghstahler, 2010; CAST, 2014; Meyer, A., Rose, D., & Gordon, D., 2014). This manifests as the ability to provide choice or freedom in course materials and course content; optimizing information relevance to everyday life or professional spaces; managing the classroom learning environment to reduce or remove threats and distractions; establishing a classroom community and promoting self-regulation. A variety of pedagogical strategies seeks to utilize this principle by establishing relationships with students (i.e. immediacy), make

course content relevant (i.e. tangibility), and create additional value in the act of knowing (i.e. knowledge is power) (Burghstahler, 2010; CAST, 2014; Meyer, A., Rose, D., & Gordon, D., 2014). In summary, the purpose of UDL is through the variance of materials, assessment and engagement to create a learning environment that is equitable and inclusive to all learners. This becomes problematic as ableism stands in stark contrast to assimilation rhetoric.

According to Keller and Galgay (2010), ableism is defined as the unique form of discrimination experienced by people with disabilities based on their disabilities. More so, the expression of ableism privileges non-disabled people through an able-centric worldview (p. 242). This approach suggests that disability is a salient identity marker that deviates from normative expectations of what people expect or perceive to be normal. Grewe (2017) supports the construction that disability is an element of normalcy, where the biomedical (social model) discourse of disability situates people with disabilities as valued less and are less capable than their abled counterparts.

Ableism has also long been used to justify hierarchies of rights and discrimination between other social groups, and to exclude people not classified as 'disabled people' (Wolbring, 2008). Ableism manifests in a multitude of ways. Covert ableism manifests as vague and/or broad institutional policies, practices and procedures within institutions of higher education. This may include, but is not limited to: accessibility/accommodation policies, no-classroom recording practices, the encouragement of note takers vs. support for assistive technology and reactionary remediation procedures, software and technology procurement processes and the misuse of Universal Design (UD) in physical

spaces and Universal Design for Learning in course design. In addition, covert ableism manifests through the scapegoating of departmental and institutional funding for support in course and curriculum design, pedagogical training and practical implementation of UDL. Further, we also see covert ableism in how accommodations are provided through language such as: documented disability; and reasonable accommodations (Hutcheon and Wolbring, 2012).

Institutions of higher education do not want to be seen as discriminatory towards people with disabilities. In fact, many institutions promote inclusive practices and in 2016, the US Department of Education published *Advancing Diversity and Inclusion in Higher education*, a 95 page document that does not mention UD or UDL, and only tangentially mentions disability once. This exclusion of disability echoes our institutional understanding of disability and ultimately promotes an ableistic approach to education. Further, with institutions of higher education hanging their hat on the rack of UDL, we inherently promote ableism under the guise of inclusiveness.

Theory vs. Practice of Universal Design for Learning

There is a misconception that the practice of UDL is a destination that can be reached. In fact, UDL should not be viewed as a destination, but rather as a journey. Each semester, year or generation of student brings with them different needs, values and views of the world they live in and these differences require us to re-evaluate, modify and enhance our approaches to teaching students through the goals we set, the methods we use, our assessments that measure learning and the course materials themselves (Hall, Meyer & Rose, 2012). This constant change can be daunting and the amount of time, effort and resources are not

built within the departmental budgets of higher education, nor the support services that assist. There is also a component of understanding that is missing from the pedagogical approaches within higher education.

Due to the lack of support, a lot of responsibility falls upon the uncompensated physical and mental labor of the instructor, the department and the school. Scholars, researchers and practitioners have sought simpler ways of managing course updates and quick solutions are privileged (Rose & Meyer, 2002). As the diversity in need that students have within the classroom grows, these quick approaches become exclusionary and reactionary in nature. This is not done out of any negative will, but rather out of necessity to meet deadlines, budgetary constraints, and accessibility compliance.

Higher education inherently misunderstands the role of disability within the identities, abilities and communities that it serves (Grewe, 2017). This lack of understanding paired with societal influences of expectations of persons with disabilities (Invisibilia, 2015) create gaps in equality that are fed by the attitudes of the faculty, students and communities within the school (Burgstahler, 2010). This creates a space where students with disabilities view themselves and their needs as a burden and creates compromised competitive spaces akin to believing in "the survival of the fittest" (p. 280).

The purpose of this project is to highlight how ableism manifests through the practice of Universal Design for Learning. Further, this project will illustrate that the practice of UDL is not a solution for ableism, but at best finds itself to be a false or partial management strategy in addressing the needs of students within

a higher education learning environment. Pulling from the dissertation data from Christopher (2016), a thematic analysis is employed to identify the unintentional ableism present within the practice of Universal Design for Learning.

This project will address the following research questions:

RQ1: How is UDL implemented within the design of a course?

RQ2: What challenges arise when implementing UDL?

These questions will help us better understand the practice of UDL and the role of ableism within course and curriculum design.

Methods

In order to explore the relationship of ableism with the practice of UDL, the research design and methodology for this study utilizes qualitative design. To more accurately speak this project employs a thematic analysis of research data collected from ten structured interviews. The objective of the interviews looked at how UDL was being implemented and the challenges faced by designers. This study was exploratory and so, understanding the experiences and viewpoints of the participants was important (Creswell, 2008, p. 174). Data was collected from recorded interviews. These interviews were structured interviews with no follow-up. The interview questions were open-ended and researcher notes were taken throughout the interviews. The interviews were then transcribed. Transcribing the interview allowed for deeper analysis.

Population and Sampling

The participants for this study were drawn from the larger population of instructional designers and designers-by-assignment who work at community colleges in the United States. The participants were drawn from The American Association of

Community Colleges and the Instructional Design Group in Linked-in.com/. The American Association of Community Colleges has 1,123 community colleges participating in their organization (AACC, 2015). The Instructional Design Group in Linked-in.com has approximately 20, 000 members (Linked-in.com/, 2015). An IRB-approved email was sent to 354 community colleges in good standing with The American Association of Community Colleges. On Linked-in.com/ in the Instructional Design Group, a discussion forum was created and posted which included the IRB-approved email. The criteria for the study participants were stated in the recruitment email and included position (i.e. instructional designer or designer-by-assignment), educational requirements, and willingness to participate and share materials. There were ten participants.

Interview Protocol

The interview protocol derived from EnActPTD: Ensuring Access through Collaboration and Technology Partnerships, Technology and Dissemination at udluniverse.com. This protocol was developed in line with the instrumentation documentation listed above. A total of eleven questions were created, with the final question aligning as a clearinghouse statement (Creswell, 2008). These questions included open-ended questions based on the research questions. The researcher used a script to help ensure consistent data collection for each participant.

Data Collection

Ten participants were recruited to participate in this project. Each participant received and signed an informed consent form and were then scheduled for a telephone interview. Each interview was digitally recorded and transcribed for accuracy. Each participant received a copy of the transcript to engage in

member checking, a process that allows participants to verify accuracy and credibility of the data (Harper & Cole, 2012).

Data Analysis

Data for the study was analyzed using a discourse specific thematic analysis introduced by Baxter (2011). The choice to use Baxter's method follows the procedures of mainstream thematic analysis procedures, such as Strauss and Corbin's (1990) constant comparative thematic analysis or Glaser & Strauss (1967) grounded theory analysis. Using this method requires for a phenomenon, event, object or setting of interest to be identified (Baxter, 2011, p. 29). For this study, a broad analytical question was used, "What is ableism?" This question created a setting and provided an object for analysis.

Selecting a Text

The text for this project was pulled from transcribed interviews collected in 2016. Although we looked at the entirety of the transcript, sections two (design decisions), three (implementation), four (challenges) and five (conclusions) were used.

Identifying Discourses

The first step in this process is to understand the current social, historical and political discourses that currently exist surrounding the concept of ableism. This process entailed reading and engaging with the academic conversation. Baxter (2011) argues that this process sensitizes the researcher and helps position data within in a larger framework. This study employed Braun and Clarke's (2006) six steps to a thematic analysis as a guideline to identifying the discourses of an acquired physical

disability. Braun and Clarke state that a thematic discourse analysis begins by being reflexive of what you are collecting and what you are reading as you move through the data to get a feel for what is happening within each story (p. 82).

Step One: Create Familiarity. This process was conducted by re-reading and listening to the interview recordings both while transcribing and while reading the finished transcripts. **Step Two: Create Codes.** The codes created for this data set are based on the analytical question, "What is ableism?" (discourse). Using the semantic object, a derivative of the analytical question, initial coding began. **Step Three: Create Discourses (Themes).** Once we had completed the initial coding, we began to compare the coded data against each other, grouping different statements and stories together based on similarity. Throughout this process, an in-depth research log and memo were created, annotating and listing direct quotes and exemplars, and coding statements in different colors. **Step Four: Review Discourses (Themes).** Once the discourses were named and identified, a definition with an in-depth description and exemplars were created. A review of the exemplars was necessary to define the boundaries of the discourses and to ensure that there was little to no over-lap within the tenets of the identified discourses. **Step Five: Defining Discourses (Themes).** After completing the review of discourses, a robust, analytical memo was created outlining each tenet that constructed the discourses identified. **Step Six: Use of Exemplars.** Using exemplars for this process involved identifying specific passages of spoken dialogue from participants as they answered questions.

Verification Procedures

Although this work does not seek to predict or explain how a phenomenon works, there is an importance placed on ensuring that data is analyzed with rigor, validity and reliability in mind. To accomplish this, three different verification procedures were used. The verification process included referential adequacy, audit trail and data exemplars. In total, 32 exemplars were pulled with 11 unique, non-repeated examples that illustrate the presence of ableism in implementing UDL.

Results

To answer the research questions, themes were identified from the responses provided by the participants. These themes provide space for exploration on the role of ableism in the utilization of strategies in implementing UDL. For research question one, four themes emerged from how UDL was being implemented. They include: the use of multimedia in applying UDL principles, using the discussion tool of a Learning Management System (LMS), the creation of self-assessments and practice tests, exams and quizzes are highly used and the creation and implementation of rubrics.

The utilization of multimedia as a tool of implementing UDL was often reported as the sole task being used by instructors. This aligns with the multiple means of representation principle within UDL. The use of the LMS as a tool for creating engagement was identified, but specifics of how the tool was used were not provided. Self-assessments, practice tests, exams and quizzes were also identified, but specifics on the implementation remained unclear and the creation and employment of rubrics echo the need for finite and tangible assessment.

The second research question provided the following themes. They include: the diversity in needs for a diverse population; challenges in communicating between instructor, students and the course materials; lack of consistency in design; and student challenges in adapting to evolving classroom environments. Additionally, there was an overarching theme across both questions of lack of support and resources available from the institution itself.

There is a level of irony present that the diversity in population emerged as the largest and most common challenge faced by course designers. Virtually every participant mentioned the challenges in reaching "all students." Communication and clarity of communication between instructors and students also emerged from most interviews. There was no mention of data collection or needs assessment on the part of the designers. The last commonality that crossed both questions illustrated the lack of support and resources in adapting, updating and implementing UDL within the different types of classroom.

Discussion

Within higher education today, Universal Design for Learning (UDL) is gaining traction as populist jargon meant to discursively communicate a pedagogy of reaching all students. This project decentralizes the practice of UDL as a mechanism that unintentionally perpetuates ableism within the academy. Within the first research question, "How is UDL implemented within the design of a course?" we found that most designers are not actually holistically applying UDL in their course design.

The use of multimedia in applying UDL principles within the classroom took the form of captioning and transcribing materials for deaf and hard-of-hearing students, English as a second-

language learners, and students with different learning disabilities. Many designers heralded this as their courses aligning with UDL principles. By providing examples through the means of multimedia, students were and are afforded an additional mean in which they can learn course content. The most common form of multimedia was video. A captioned video provides most students with a non-reading method of learning information.

On the surface, providing a video as an ancillary or auxiliary piece of course material seems to be a great idea. Many students would benefit from the ability to watch a video on a course topic that was first introduced in class. However, the fact that this is the most popular practice reported as aligning with UDL does not take into account for people who have other physical disabilities or processing disorders. This practice creates saliency of the needs of certain populations, while being exclusionary towards others.

The reporting of using the Discussion tool within an LMS as a method of applying the principle of engagement within the course was identified as the most used LMS tool. Although not thoroughly explained, we operationalized this practice as finding ways for students to connect with each other and the instructor and as a mechanism for instituting community and engagement in the classroom, specifically an online classroom. It was reported that some discussions have a structured format and some discussions have a more open-ended format for answering questions or discussing topics.

This approach to engagement privileges students who can articulate themselves well in written form, while furthering the marginalization of students who cannot. In addition, instructors

who utilize time limits or time restrictions while using this tool create a challenge for students who use assistive technology. If using this tool as a major way to engage students, some students might be left out. This approach alone does not meet the criteria for pedagogical and meaningful and practical implementation of UDL.

A lot of attention was also placed on the importance of creating self-assessments and practice tests, using exams and quizzes. This is one of the oldest and most used forms of assessment in western education, as highlighted by Friere (2018) and is easily quantifiable. Whether for points or self-assessment, the use of exams and quizzes arises as the primary method of implementing meaningful assessment. Second to this comes in the form of essay and other forms of formal writing.

Self-assessments, practice tests and other forms of structured assessment privileges some students over others. Students with learning disabilities, processing disorders or students who lack strong comprehension skills suffer from this type of assessment. As Stiggins (2004) illustrates, these assessment tools are out-dated and naïve to today's learner. Holistic and varied assessment can not only measure student learning, but also create a benefit for student learning. This method challenges the traditional methods of assessment and requires nuance for measuring student learning for UDL.

Finally, the creation and implementation of rubrics as an assessment measure is not new to higher education. With the growth of programs like, Pathways, it is not surprising to see more rubrics being used to assess student learning. Rubrics create an equitable playing field for students and instructors to measure how they are being assessed in learning. Designers report that

good rubrics are those that students can understand and apply to their own work. Whether this takes the form of an exam, an essay or a discussion, rubrics are created to provide students with the understanding of how they will be graded.

The challenge of rubrics is two-fold. First, rubrics are created to produce similar outcomes from all students. To more accurately speak, a rubric is designed to measure student learning based on a set of criteria set forth by the instructor. This in and of itself promotes a standardized assessment for learning that does not take into account the differences amongst students. For some students, the ability to articulate “perfect” spoken or written English is not realistic, nor does it reflect a diverse and inclusive worldview. Most constructions of “perfect” spoken or written English is colonialistic in nature and privileges a white, abled and learned education. Second, rubrics allow for interpretation that does not account for implicit bias.

The second research question, “What challenges arise when implementing UDL?” provided a rich understanding of how ableism permeates the educational system as a whole. This question also illuminated the gap between theory and praxis by providing tangible evidence to the vague/broad policies, procedures and practices within the higher educational system. Additionally, this question allowed us to better understand the role of resources and support within the implementation of UDL in higher education.

The first theme, the diversity of students and student needs being the greatest challenge that designers face was surprising. The purpose of UDL is to help designers create courses that reach a greater number of students. One designer stated that because of

the challenges presented by the diversity of students, it was impossible to meet all the needs of this diverse population (Christopher, 2016, p. 92). Burgstahler (2010) states that the characteristics of this diverse population include: physical, visual, hearing, learning, attention, and communication differences (p. 5). We would add that cultural, socio-economic, geographical, ethnic and age-based differences also create problematic environments for course development.

It is not surprising that within this theme, challenges arise when designing courses. In homogeneous communities, some of these differences may not be present, but as we better understand the approach to intersectional identities, course development will also need to evolve. Emmert (2010) states that:

Diversity efforts of many post-secondary institutions originally focused on gender, racial and ethnic issues. Institutions that have expanded their definition of diversity to encompass such characteristics as: sexuality, religion, age, socio-economic status, nationality and disability are fertile ground for the promotion of the overarching concept of UD. Institutions with a narrower vision of diversity are less likely to embrace UDHE [Universal Design for Higher Education] (p. 280.

By identifying the need for broadening our understanding of diversity, there is an inherent need to increase the breadth of how we design using UDL (Hehir, 2002). Further, ableistic practices become addressed as we include additional identity markers within our consideration for design.

The second theme is centered around the concept of communication between instructors, students and the course materials and student's ability in adapting to evolving learning

environments. These challenges speak to an ever-evolving classroom environment that takes advantage of face-to-face, hybrid and online learning. Challenges in communication range from creating immediacy between the instructor and the student, establishing investment or connection to the course material and articulating the value of the course material to students.

Establishing strong communication between various groups of diverse people is always challenging. Shared levels of understanding are needed to communicate effectively and today's modern classroom is no longer homogeneous. Differences in age, ability, cultural backgrounds, and other identity markers create difficulty and call for the need for diverse trainings for course designers, instructors and students.

Ableism is extremely prevalent in the challenges that communicating among instructors, students and course materials. Assistive technology can bridge the gap between students and instructors, but in-and-of-itself can be a hindrance as language is translated from text to speech. Access to accessible course materials, including the syllabus can prevent students from understanding classroom and course expectations. And the lack of training for instructors on inclusive teaching practices may create a lack of knowledge and understanding between an instructor and their students.

The third theme dealt with the lack of consistency in designing with UDL. From aesthetics to approach, the lack of consistency creates unique challenges at every institution. Consistency in course layout creates for students a space where they do not have to question how to navigate the LMS, but rather would allow students to spend more time learning. Hutcheon and

Wolbring (2012) suggest that a collaborative approach between faculty, designers and students in laying out course design provides the best possible space for usability. “Finally, the language of policy that addresses the needs of the ability-diverse population should be changed to include non-ableist and inclusive sentiments” (p. 48). This statement reflects the disconnect between inclusive educational design and ableism perfectly.

Conclusion

The overarching theme across both questions centered on the lack of resources and departmental/institutional support available to course designers. At the end of the day, the implementation of Universal Design for Learning requires institutional and departmental support. As the diversity in our student population grows, so does our need to update and create new materials. The presence of ableism emerges from the gaps between creation and support and has been illustrated throughout this project.

Covert ableism is prevalent within the approaches taken through institutional policies, practices and procedures. It is also reinscribed every time we create and adapt as there is no one way of serving all students. Rather, there is a need to truly establish multiple means of representation without replacing or preventing access to one means of learning, while still being able to access all means of learning. Further, covert ableism is reinforced through our reliance of assistive technology and accessibility compliance. Equity does not equal fairness, nor freedom and by promoting reactionary spaces, where materials are only adapted after a complaint or in fear of a complaint does not benefit all students.

As we move forward, more thought should be placed on how ability, ableism and disability are incorporated into our course design. Choosing texts, course materials and learning technology should be inclusive for all students, regardless of ability and while UDL provides us the framework to accomplish this, we fall short in our application. As a whole, UDL is an incredible tool to enhance our current educational model, but the practice of UDL still perpetuates the same ableistic approach to teaching and learning.

References

- American Association of Community colleges (2014). Community colleges trends and statistics. Retrieved from <http://www.aacc.nche.edu/AboutCC/Trends/Pages/facultydegreeattainment.aspx>**
- Association on Higher Education and Disability (2016). AHEAD program standards and performance indicators. Retrieved from <http://www.ahead.org/about/Final%20Program%20Standards%20with%20Performance%20Indicators.doc>**
- Baxter, L. A. (2011). *Voicing Relationships*. Los Angeles: SAGE.**
- Brault, M. (2012). *Americans with disabilities: 2010*. Retrieved from <http://www.census.gov/prod/2012pubs/p70-131.pdf>.**
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3, 77-101. DOI:10.1191/1478088706qp063oa**
- Burgstahler, S. (2010). *Universal design in higher education*. In S.E. Burgstahler & R.C. Cory (Eds.), *Universal design in higher education from principles to practice*. (pp. 3-21). Cambridge, MA: Harvard Educational Press.**
- CAST Center for Applied Special Technology (2012). *UDL guidelines version 2.0*. Retrieved from <http://www.udlcenter.org/aboutudl/udlguidelines>**
- Christopher, L. N. (2016). *Universal design for learning: Implementation and challenges of community colleges*. (Doctoral dissertation).**
- Creswell, J.W. (2008). *Educational research: Planning, conducting and evaluating quantitative and qualitative research (3rd ed.)*. Upper Saddle River, NJ: Pearson.**

- Emmert, M. (2010) Forward. In S.E. Burgstahler & R.C. Cory (Eds.), Universal design in higher education from principles to practice. (pp. 248-249). Cambridge, MA: Harvard Educational Press.**
- Glaser, B., & Strauss, A. (1967). The discovery of grounded theory. 1967. Weidenfield & Nicolson, London, 1-19.**
- Grewe, Jr., B. (2017). Reframing the gender communication classroom: Utilizing disability pedagogy. In M. S. Jeffress (Ed.), Pedagogy, disability and communication: Applying disability studies in the classroom (pp. 81-96). New York: Taylor and Francis**
- Harper, M. & Cole, P. (2012) Member Checking: Can benefits be gained similar to group therapy? The Qualitative Report 17(2). 510-517. Retrieved from <http://www.nova.edu/ssss/QR/QR17-2/harper.pdf>.**
- Hehir, T. (2002). Eliminating ableism in education. Harvard Educational Review, 72(1), pp. 1-32.**
- Hutcheon, E. J. and Wolbring, G. (2012). Voices of "disabled" post secondary students: Examining higher education "disability" policy using an ableism lens. Journal of Diversity in Higher Education, 5(1), pp. 39-49.**
- Keller, R. M. and Galgay, C. E. (2010). Microaggressive experiences of people with disabilities. In D. W. Sue (Ed.), Microaggressions and Marginality: Manifestations, Dynamics, and Impact. (pp. 241-268). Hoboken, NJ: Wiley and Sons.**
- Meyer, A., Rose, D., & Gordon, D. (2014). Universal design for learning. Wakenfield, MA: CAST Professional Publishing.**
- National Center for Educational Statistics. (2011). Students with disabilities at degree-granting postsecondary institutions: First look. Retrieved from: <https://nces.ed.gov/pubs2011/2011018.pdf>**

Rosin, H. and Spiegel, A. (Invisibilia). (2015, January 23). How to Become Batman [Audio podcast].

Stiggins, R. (2004). New assessment beliefs for a new school mission. Phi Delta Kappan 86(1), pp. 22-27.

Strauss, A., & Corbin, J. (1998). Basics of qualitative research: Techniques and procedures for developing grounded theory. Thousand Oaks, CA: SAGE.

Walbring, G. (2008). The politics of ableism. Development, 51(2), 252-258.

doi:<http://dx.doi.org.du.idm.oclc.org/10.1057/dev.2008.17>



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Stephen Knowles (Pronounced with a "V" sound) has been working intermittently in Arapahoe Community College's (ACC) eLearning department, focusing on digital accessibility and inclusion. Stephen has worked as a help desk representative for students and instructors at ACC. Unlike his colleagues, Stephen's formal education ends with High School, however, he supplements the difference with a variety of workforce experiences. Each of those experiences has led Stephen to appreciate the steps he has taken towards including everyone and ensuring that anyone could have a fair opportunity at applying what they know.

Applying Universal Design Fundamentals in a Technology Education Environment

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Abstract

This article provides technology educators with multiple methods for increasing inclusion. It defines Universal Design for Instruction principles, how they can increase accessibility in classes where they are applied, and gives examples for their application in technology-based coursework. Project Based Learning is the technique of choice for many technology educators, and while successful for the students that are capable of self-motivation and self-agency, students that perform poorly in groups and are unable to articulate their ideas can suffer.

Technology education classrooms are also often ill-prepared for students with disabilities when lab equipment is involved, stressing the need for more inclusive practices to be adopted in technology education, with UDI being a comprehensive series of principles that can significantly increase engagement and inclusion when implemented in the PBL pedagogy.

Keywords:

Project-based, education, engagement, pedagogy, technology, inclusion.

Definitions:

Universal Design of Instruction (UDI) – Universal Design of Instruction (UDI) is the design of instruction that can be used by all students without the need for adaption. This design includes instructional materials, facilities, and strategies (Burgstahler, 2010).

1.0 Introduction

As the technological abilities of our society continue to increase and become more complex, educating students in the varied fields of technology has become a topic of interest for the education community. Buzzwords like “STEM (Science, Technology, Engineering, and Math) and “Project Based Learning” are known to educators, students, and parents alike, and schools that offer a technology education are increasing in desirability as institutions parents want to send their children to and locations teachers are interested in working. With the rise of technology education, the question of how technology education can be made available to everyone also grows. Many education techniques, such as PBL, claim to increase understanding and retention amongst students with accessibility concerns, but do they truly make technology accessible to everyone? In this article, we will be exploring PBL’s

application in technology education and the areas where inclusion can be improved. We will also be introducing Universal Design for Instruction, a set of core principles for increasing student inclusion in education environments and relate how its core mission aligns with that of Design for All. We will also be providing examples where UDI and PBL can coincide and work together to maximize student engagement and accessibility in an education environment that has historically been difficult to make inclusive: technology.

1.1 Universal Design for Instruction

Universal Design for Instruction (UDI) is a fundamental aspect of inclusive design frameworks and pedagogy. With many aspects and principles, UDI has grown to become an important tool for creating inclusive and inviting environments tailored toward a wide range of ability levels. With this in mind, what exactly is UDI and why should we as instructors focus on using it in our courses and pedagogy?

By exploring the 14 combined principles of UDI we'll understand how we can implement UDI principles in our pedagogy and classroom environments. UDI comprises the principles of Universal Design (UD), Universal Design for Learning (UDL), and Web Content Accessibility Guidelines (WCAG) (Burgstahler, 2020, p. 43). Examining these principles, we can see how they contribute to UDI as a whole, and how they individually affect learning outcomes. Sheryl Burgstahler in her book *Creating Inclusive Learning Opportunities in Higher Education: A Universal Design Toolkit* lists the 14 UDI principles as follows:

For Universal Design

1. *Equitable Use*

- 2. Flexibility in Use**
- 3. Simple and Intuitive**
- 4. Perceptible Information**
- 5. Tolerance for Error**
- 6. Low Physical Effort**
- 7. Size and Space for Approach and Use**

For Universal Design for Learning

- 8. Multiple Means of Engagement**
- 9. Multiple Means of Representation**
- 10. Multiple Means of Action and Expression**

For Web Content Accessibility Guidelines

- 11. Perceivable**
- 12. Operable**
- 13. Understandable**
- 14. Robust (Burgstahler, 2020, p. 43)**

While each principle presents useful and important guidelines for inclusivity and adds important aspects to the overall UDI framework, this article will focus on the implementation of specific principles within technology pedagogy, though we will briefly overview each principle.

Equitable Use focuses on creating as similar of an experience as possible for all users, explained best in the words of Sheryl Burgstahler: "Provide the same means for use for all users: identical whenever possible; equivalent when not". (Burgstahler, 2020, p.37) Flexibility in Use focuses on creating an experience that is usable by users with different abilities and learning preferences. (Burgstahler, 2020, p.38) Simple and Intuitive Use focuses on ensuring that content is understandable and usable by

users with different experience levels, knowledge, and language skills among other aspects. (Burgstahler, 2020, p.38) **Perceptible Information** outlines providing essential information to users in an effective manner regardless of learning conditions or abilities (for example, using pictures in conjunction with audio). (Burgstahler, 2020, p.38) **Tolerance for Error** details predicting and accommodating for possible errors and unintended actions and consequences of use and minimizing hazards. (Burgstahler, 2020, p.38) **Low Physical Effort** outlines creating designs that “can be used efficiently, comfortably and with a minimum of fatigue”. (Burgstahler, 2020, p.38) **Size and Space for Approach and Use** relate to creating spaces that accommodate and provide appropriate space for users of different sizes, postures, and mobility. (Burgstahler, 2020, p.38)

Multiple Means of Representation outlines providing multiple means to present content that accommodates users of different language, comprehension, and ability levels. (Burgstahler, 2020, p.42) **Multiple Means of Action and Expression** details giving users multiple opportunities to express themselves through their work, for example by allowing students to submit a video essay instead of a written one. (Burgstahler, 2020, p.42) **Multiple Means of Engagement** involves providing multiple ways for users to engage with content, such as providing video lectures alongside textbook readings. (Burgstahler, 2020, p.43)

Sheryl Burgstahler provides an excellent overview of the 4 principles of WCAG:

1. **Perceivable.** *Users must be able to perceive the content, regardless of the device or configuration they are using.*

- 2. Operable.** *Users must be able to operate the controls, buttons, sliders, menus, etc., regardless of the device they are using.*
- 3. Understandable.** *Users must be able to understand the content and interface.*
- 4. Robust.** *Content must be coded in compliance with relevant coding standards to ensure it is accurately and meaningfully interpreted by devices, browsers, and assistive technologies. (Burgstahler, 2020, p.41)*

The importance of including UDI principles in pedagogy is to create inclusive environments and present equal opportunities for learners of all ability levels to achieve their educational goals. Creating environments in which a learner with a disability can succeed will broaden the educational reach and provide many benefits to both learners and educators, including higher enrollment rates and opening paths to success for everyone.

1.2 Comparison to Design for All

Universal Design presents many actionable guidelines that educators can follow to create more inclusive environments. Design for All builds upon this as well, presenting a vision for the overall goal of Design for All and Universal Design: creating inclusive environments for all. The Design for All Foundation describes Design for All as “Design for All is the intervention into environments, products, and services which aims to ensure that anyone, including future generations, regardless of age, gender, capacities or cultural background, can participate in social, economic, cultural and leisure activities with equal opportunities.” (Design for All, 2022)

Where Universal Design provides the how, Design for All provides the why. Why are we using Universal Design principles in our pedagogy? Why should we care about Universal Design at all? Design for All focuses on the goal and the parameters that focus us on why Universal Design is fundamentally integral to inclusive practices.

1.3 Characterizing Technology Education

Due to its relevance to the professional community, technology education is often at the forefront of innovations in pedagogical approaches. In addition, due to its nature technology education does not lend itself to a standard classroom experience, with lecture-based teaching followed by at-home learning or self-study being difficult to apply to a field of study that is multidisciplinary and encompasses such a large range of Science, Technology, Engineering, and Mathematics (STEM) concepts during any given classroom period. This necessitates varied approaches in course work and instruction to maximize student learning and engagement.

In this context, we refer to Technology Education as the familiarization of students with professional fields including chemistry, mechatronics, software, hardware, and other technology fields in a classroom environment. Technology Education focuses on the application of STEM concepts in knowledge in the furtherment of a defined end goal. This can be a solution to a problem, an investigation into an outcome or result, or other applications that allow a student to use STEM concepts they have learned through other coursework or from personal experience, and usually includes factual, conceptual, and application-based learning techniques (South Dakota Department of Education, 2022).

Examples of a Technology course might include: Robotics, Integrated Circuits, Aerospace, Composites, and/or Prosthetics. They might be taught in a conventional classroom or a lab-based environment but could also be held on-location at a site relevant to the subject matter, like a manufacturing plant or water treatment facility. It is this ubiquity that makes technology education a challenging but rewarding study that requires non-standard teaching techniques to meet its instruction needs.

1.4 Project Based Learning

One of the many ways Technology Education addresses its need for non-standard teaching techniques is through the use of Project Based Learning (PBL). PBL is encapsulated as an “ill-defined task within a well-defined outcome” (Capraro et al, 2013) and focuses on applying knowledge as it is learned towards an end goal that is heavily emphasized to students throughout the course of the project. While PBL can be used for individuals, its broader applications (and true strengths) come from being utilized in small groups of students that collaborate on their solution. This approach mirrors the rotating project groups currently utilized in the tech industry, which contributes to its effectiveness and popularity in Technology Education.

PBL techniques usually involve a series of short-run projects based on a topic discussed in the course where the class is split into pairs or small groups and then given a task to complete together. The parameters of this project are intended to be vague to promote creative thinking and each group creating their own solution to the task based on the set of skills and ideas they possess. The project will usually culminate with a presentation to the rest of the students where the project group will describe

their final solution to the given task and the process they took to get there. Groups are encouraged to ask questions of the presenting group and compare and contrast their experience to that of the presenting team. In a PBL environment the instructor acts as guide rather than a strict teacher and keeps project teams on track and engaged with each other, allowing the process of the project and the experiences gained from working together to drive student learning on the subject matter.

PBL techniques could be implemented once during an otherwise classical lecture environment, periodically over the length of a course, or PBL could be used exclusively as the teaching technique of choice depending on the nature of the course and the intentions of the instructor. A class about advanced electronics could be taught exclusively with labs and projects based around the many kinds of integrated chips and electrical components, while a material class may require some lecture time to address the underlying mathematical concepts that support the course material. A teacher's experience or preference also contributes to the usage of PBL, as teachers who are not confident in their lecturing abilities may employ PBL more liberally than a teacher who has been using lectures and textbooks for the majority of their career. PBL draws strength from its adaptability in execution, increasing the chances that a technology student encounters it in the classroom.

PBL has rapidly gained traction since the beginning of its widespread adoption in 1965 after a long period of anonymity. High Quality Project Based Learning (HQPBL) is an organization that seeks to further PBL adoption in academic institutions and has tracked 3236 schools utilizing PBL principles as of the writing of this publication. (HQPBL, 2022). This rapid adoption is

unsurprising to educators that work within Technology Education, as it addresses a number of key issues that are systemic to the field. Broadley, these issues include:

- *Technology concepts are difficult to teach in a conventional lecture-based classroom.*
- *This is due to the large volume of technical knowledge that is a prerequisite for understanding certain technology concepts. The more STEM fields a subject encompasses only further compounds this problem, as there is an increase in prerequisite knowledge required to understand the subject at hand.*
- *If the prerequisite knowledge of the students is unknown to the instructor this can result in limited advancement in the principles the course intends to teach.*
- *A student's performance in STEM subjects does not always predict their success in a technology class.*
- *Students that perform well in their STEM coursework could be expected to perform well in a technology class that utilizes STEM concepts. However, what is often the case is students struggle with applying the conceptual knowledge they have learned in a math or science class to an ill-defined problem, one that heavily diverges from the clear starting conditions normally provided by questions found in math and science coursework. These are the classification of problems the tech industry is built on solving, resulting in a disparity. Conversely, students that perform poorly in STEM classes can be more adept than their peers at framing these ill-defined problems depending on their background. Students that have never taken a STEM course may have applicable skills that allow them to define a problem in physical and measurable terms, especially for post-secondary*

education where the backgrounds and life experiences of students are more varied.

- ***STEM education has historically struggled to prepare students of different genders, races, learning ability, and socioeconomic backgrounds equally.***
- ***Due to the rigor involved with the coursework of STEM subjects, students with greater resources for studying, tutoring, and practicing outside of the classroom positively correlate with a better understanding of STEM subject matter (Nikischer, 2013). The same is true for Students with Disabilities (SWDs), where the large volume of information that is conveyed during a short period can create difficulties for students with learning disabilities, and the varied learning environment of Technology Education can pose problems for physically disabled students. Finally, STEM fields are dominated by men even after many social initiatives to rectify this disparity (Bloodhart et al, 2020). Non-male and LGBTQ students routinely feel like they have to fight for space in STEM education and work harder than their peers to get the same level of help and resources (Brinkworth, 2016).***

PBL techniques allow technology concepts to escape the confines of the classroom and allows students to apply their knowledge. By participating with peers on a project, students can combine their understanding of the concepts presented in the coursework with those of others, providing new perspectives to concepts that are well understood and those that require expanding. All students are directly engaged by having to interact with each other, and students with different backgrounds and experiences become assets to the group. PBL techniques also increase understanding by utilizing multiple means of engagement outside of textbooks and lectures, accommodating students that normally struggle

under the standard education model, such as students with attention issues.

These aspects of PBL make it an attractive teaching tool for technology teachers, with many successful applications such as this Microprocessor Course from Chitkara University (Singh & Singh, 2011), however, PBL is not limited to technology teachers or even teachers in STEM subjects. Utilizing PBL techniques have resulted in increases in information retention and self-efficacy in non-technology subjects, particularly those with learning difficulties (Filippatou & Kaldi, 2010). To technology educators, the value of PBL is clear. But is it really as inclusive as it claims?

2.0 Shortfalls of Project Based Learning

2.1 Engagement Problems with Project Learning

Project Based Learning (PBL) has many strengths over classical teaching techniques when it comes to engaging students that have difficulty in maintaining attention or sitting for long periods of time, reduced understanding from written or oral instruction, and students who are historically low-achieving and/or disengaged (Filippatou & Kaldi, 2010). But for all its strengths, PBL does not always engage every student due to social roadblocks fundamental to its project structure. During a project, students are expected to cooperate with their peers and contribute equally to their final solution. However, students who are not comfortable in situations that require them to talk, plan, or discuss ideas with their peers can be left out of the learning process. Students who are louder and more outspoken about their ideas are more likely to drive the direction of the group project and disproportionately utilize course resources. This results in the students who are already succeeding academically getting more

help, while the students who truly need it receive less. This disparity only compounds over time and can be difficult to correct, as antisocial students later in their educational career can be labeled “under-achievers” and “troublemakers” by teachers and their continued education can be affected by the stigma.

Students are not free of responsibility in the PBL environment either. Since PBL places the learning agency load upon the student, students who have difficulties self-motivating can struggle in a PBL course. The difference in teaching style in PBL can also make the transition in teaching styles difficult for students resistant to change. When these factors come together, especially if the application of PBL is inconsistent across a student's coursework, some students may choose not to put any effort into their projects at all and engage with teachers and peers only enough to maintain the appearance of engagement and learning. This behavior was coined in a study by Maastricht University as “ritual behavior” (Domans et al, 2001) and is an established frustration for anyone who has worked in a project group with a group member exhibiting ritual behavior. Even if only one student is failing to carry their weight in a project, it can affect the performance of the entire group, reducing their ability to make connections to new information and make an adequate attempt to research and analyze the problem assigned to them. This can affect their final evaluation for the course, depending on the grading method used by the instructor, which can, in turn, create a domino effect within the project group that further reduces the value of any learning outcomes that were produced. This can negatively impact a student's opinion of PBL, regardless of how effective the technique is.

2.2 The Onus of Education

In the previous section we discussed how students are responsible for the majority of their learning outcomes within a PBL model, but that does not mean that instructors are removed from the process. Teachers define the terms of the projects, the criteria that must be met for a project to succeed, the resources available to project groups, and are still expected to support each group and lead them towards making the concept connections and participating in the critical thinking that is a cornerstone for success in the PBL pedagogy. If an instructor does not actively support their project groups in their learning journey, the learning outcomes from PBL techniques are significantly degraded and can render the approach unsuccessful. This kind of inattentiveness can often be seen in novice or inexperienced teachers unfamiliar with the PBL pedagogy, even when all the materials for a PBL technology course are provided to them. (Brinkerhoff & Glazewski, 2004)

Regardless of the educational benefits of PBL, a transition between pedagogies results in an increase in workload on that of the instructor. While a project based approach can decrease the active workload of a teacher in the long-term due to its self-organizing approach, in the short term the conversion of materials from a classical course to that of a PBL course can be daunting for a teacher, especially if they are unfamiliar with the concept of PBL. As the popularity of PBL increases and school administrations take note of the attractive standardized grade increases and improved engagement from students it promises, many teachers are finding themselves pressured to adopt the PBL pedagogy without the resources to implement it properly. The engagement of an instructor as a facilitator and the set-up of the ill-defined problem that results in a well-defined outcome is necessary for

PBL to succeed, and without it the engagement benefits for at-risk and learning deficient students is largely lost.

2.3 Fixing the Non-inclusive Design of Technology Education

Many institutions today are unaware of the key pillars of PBL that must be maintained for it to succeed due to their inexperience with the pedagogy. The Dunning-Kruger effect, which describes how people with a minimal understanding of a concept can often overestimate their comprehension and be resistant to correction, affects many educational institutions as they begin to implement PBL.

There are many organizations, such as the HQPBL, that work hard to improve knowledge surrounding PBL and its counterparts and ensure that there are many resources available for would-be converts to provide a high quality and effective PBL lesson plan for their students. However, is this enough to guarantee that every student remains engaged in their learning and concludes a PBL course with comparable learning outcomes to their peers? How as educators can we ensure that our students accept responsibility for their education under the PBL model and are provided the resources they require to succeed, regardless of their physical, intellectual, or emotional needs? Enter Universal Design.

Universal Design (UD) helps ensure that PBL approaches are prepared to handle the needs of every student before they even enter the classroom. By considering UD principles in the creation of coursework, educators can address inclusion problems before they happen, and these principles can help drive classroom practices so students that are struggling to work with their group

or are engaging in “ritual behaviors” can be intercepted before their learning outcomes are effective. In the next section, we’ll be presenting some guidelines and examples for integrating UD with PBL.

3.0 Universal Design for Technology

3.1 UDI Principles

The idea of 14 individual principles making up the framework for Universal Design for Instruction (UDI) can be daunting when first learning about and implementing UDI in your materials. However, many of these principles work together and build upon each other creating an intuitive structure that becomes easier the more you use it.

Breaking the UDI principles into their individual groups also helps prevent being overwhelmed and to understand the situations as well as the ways that each principle or group of principles are best implemented. Looking at the three groups of Universal Design (UD), Universal Design for Learning (UDL), and Web Content Accessibility Guidelines (WCAG), we can see what areas they were originally designed for.

For Universal Design, we can see that these principles were mainly designed for physical environments and physical manipulation, and while some principles can be applied to digital means, largely Universal Design is focused on the physical considerations of design. This is supported by the Rocky Mountain ADA (Americans with Disabilities Act) which explores the history of Universal Design and its original intentions for physical environments and architecture (Simmons, 2020).

With UDL, these principles were understandably created with pedagogy considerations in mind. While these principles are focused largely on pedagogical applications, they can also be applied in other areas and can be mixed with UD or WCAG principles to create accessible media outside their originally intended purposes.

WCAG principles, as indicated by its name, were created for digital use (Birney, 2020). As with UDL and UD principles these principles can function in areas outside of digital environments and can be used in conjunction with other UDI principles to bolster and improve materials.

Understanding the differences between these groups helps to tailor our materials and approaches to the situations in which they are necessary. This also helps us to employ the right tools for the job, using the right measurements and standards for each task we undertake.

When creating curricula for courses and deciding on teaching methods, placing special consideration into how each of the 14 principles of UDL will affect your teaching style and individual lectures will help to create an inclusive course. Further, placing thought into the situations and medium considerations you'll be making during the course will help to determine what UDL principles, guidelines, and frameworks will be needed for each aspect of the course. For example, in a technology course where your lecture may contain typing on a computer, consider UD principles in the physical aspects of the lesson. Ask questions such as "are the computer desks inclusive of users of different sizes, postures, and stances such as standing or sitting?" "does it require extensive physical effort for a user to interact with this

activity?" and "can users make some mistakes during this activity and not detriment themselves?" (Burgstahler, 2020, pp. 38-39).

This example also shows how UDI principles can intermingle with materials, as you can also benefit from considering UDL principles when creating this activity. Asking questions in this vein will help less with the user's experience of the activity, and more with ensuring that users understand the activity and are able to complete required goals in a satisfactory manner. Ask questions such as "are there multiple ways that the user can receive instructions and assignment goals, such as videos, written or typed hand-outs, and audio?" "could second-language users and users of different cognitive ability levels still understand these instructions" and "are there multiple ways that a user could reach the end goal of this assignment satisfactorily?" (Burgstahler, 2020, pp. 37-43).

3.2 Multiple Means of Engagement

An important part of UDI that is often underutilized and overlooked is multiple means of engagement. This principle focuses on using multiple mediums for presenting course content, such as using video lectures and textbook readings (Burgstahler, 2020, p.43). An important part of this principle is to ensure that whatever information is important is accurately represented in all the different forms of media you choose to use. Essentially, if you are using textbook readings and video lectures, ensure that the information the user is receiving is as equal as possible from both mediums (which relates to the UD principle of equitable use as well) (Burgstahler, 2020, p. 43). If important information is presented in one medium but not the others, the use of multiple means of representation is negated if the user still has to interact with all of the various mediums.

The purpose of this principle is to create opportunities for users to engage with content in ways that best fit their individual learning styles and preferences. Users may prefer and learn best from video lectures over textbook readings, or vice versa. A sight-impaired user may struggle to interact with printed media and may have an easier experience with digital media. Users may choose to interact with only one option that you provide, but providing multiple options ensures that all users can get the most out of your course materials.

While often underutilized, this principle can be fundamental to students' learning experience, gained knowledge, and understanding of course material.

3.3 Providing Examples of Desired Coursework

Another overlooked aspect of UDI is the principle of providing examples for your coursework, instructions, and lessons (Burgstahler, 2020, p. 43). Any user who has created instructional material may know the difficulty associated with explaining a complex concept to a learner. Creating instructions can be difficult, as the possibility of misinterpretation, missing important details, or creating a confusing piece of material becomes more likely the more complex the document and subject of the document becomes. It is for this reason that providing examples of what you're looking for from your coursework can be so important.

Placing the principle of providing examples into a UD perspective, we see that this is important for all users, including users who may have comprehension disabilities. Providing examples for your coursework will not only help students better understand what you're looking for from them but will also help students grow and

improve in their own work. By providing an example of what good (or even exemplary) work looks like, students get an idea of what they need to do to succeed and can compare the example against their own work. Providing examples, therefore, serves a dual purpose, by providing examples instructors provide a template for how a student should complete their work while also providing a secondary lesson on what a good response to the original lesson looks like, thereby cementing the learning goals of the original lesson and improving student skills in multiple areas through a single action.

What should we consider when providing our examples, then? Our examples should at the least exemplify the minimum requirements a student would need to meet to pass the assignment. Essentially, if a student took the example, replaced the content with their own, and submitted it they should be able to pass the assignment. This should not encourage plagiarism; the intention is to provide the students with a structured guide for what they need to complete. As an example of this, consider assigning an essay to a student. When providing an example of this essay, provide an essay that would meet the requirements, and show in your example how it meets the requirements. This may appear like an outline, where each section is separated by headers that explain what should be in the section. This may also appear like a submitted student assignment, where the contents aren't necessarily important, but the formatting and length are. The goal of providing these examples is to show the student exactly what you want (whether at a minimum or providing an example of what exemplary work would look like) to give them direction and bolster the instructional materials you have provided.

Providing these examples will help to eliminate, or at least minimize, misunderstandings and misinterpretations of your instructions. By providing exactly what you're looking for from your students, they will be less likely to become confused and will be more likely to perform the work you're looking for from them. They also won't miss important aspects of the paper such as formatting requirements, important questions to answer, or important steps to take. Often, students can struggle with things like citations or step-by-step instructions, so providing an example of what a good citation or execution of a step looks like provides the students with the tools they need to correctly execute important aspects of the assignment. Finally, students are less likely to be confused about the parameters of the assignment, like goals, length (if applicable), and concerns to consider if they have a tangible example of the end goal available to them.

4.0 Considerations for Universal Design in a Lab Environment

4.1 Challenges of Student Safety

UDL concepts strives to increase accessibility for any student that may wish to participate in a course, and their integration into PBL pedagogy can maximize the ability for students of all abilities to participate in the classroom equally. However, in an implementation with a technology focus, many environments that are necessary for teaching a technology or STEM course involve the use of lab classrooms. These classrooms typically contain toxic chemicals or dangerous machines that can pose safety risks to students if improperly handled. One drawback of technology education is that some of these materials cannot be safely handled by students with disabilities, especially physical disabilities. This creates a conflict with UDL principles, where

some lab environments can be made accessible for students with disabilities in order to complete the task required by the project but may place them in a dangerous or unsafe situation because of it. This creates a balancing act for the technology educator trying to maximize accessibility while still maintaining a safe environment, and when it comes to compromises concerning safety, safety normally wins.

Educators often run into the problem of old and outdated teaching facilities that were not designed for accessibility and are not Americans with Disabilities Act (ADA) compliant. Per Title II of the ADA, schools are not required to bring their buildings into ADA compliance, but if they do not, they may not offer programs that enroll students with disabilities in those buildings. Many schools will avoid updating their existing facilities by relocating programs to a different classroom that is accessible. For technology classes this is not always achievable, especially if the equipment is specialized or only exists in a specific room. This can greatly hamper PBL techniques especially if the class must be split for accessibility reasons. While every effort should be made to make lab environments accessible to everyone, educators do not usually get a say in the matter. There are some solutions we can implement as educators, however. The Wheelchair Woodworker Shop is a comprehensive article that details proper accommodations for retrofitting a wood shop to be accessible for wheelchair users (Stephano, 2011) and an investigation from the American Chemical Society lists recommendations for how to train visually impaired students to use existing chemistry laboratories. (Nepomuceno et al, 2016).

4.2 Compromises in Universal Design

Despite our best efforts as instructors, even when adhering to the UDL principles, there will be some course elements that cannot be adapted for all students. These are concerns that technology educators are not always cognizant of before considering UDL or until a student that requires specific facility requirements is encountered. UDL principles encourage educators to adapt their coursework to be usable by any and every student that may take the course, but in the process of applying them to your teaching materials, there may be some elements that cannot be effectively adapted to everyone. In these cases, adjustments should be made that accommodate the largest subset of the differently-abled population. UDI principles cannot always be implemented, and in some cases certain accessibility measures implemented to help one group of students can actually make the course more difficult for others.

4.3 Inclusion Is Not Zero-Sum

The biggest takeaway a technology educator should have from UDL principles is that while some compromises in inclusion cannot be escaped based on the nature of technology coursework, that does not mean that inclusion initiatives should be abandoned. UDL is not an all-or-nothing system, the 14 principles can be applied in any combination and to varying intensities. Even if your classroom is in a shop or lab environment that is unsafe for certain students to utilize and cannot be replicated in a digital environment, that does not mean there is no value those students can gain from the course and should not discourage you from trying to include them, even if you are unsuccessful. This examination by Zesski and Wedler shows how students with hearing and visual disabilities can still participate in chemistry laboratories and have successful

learning outcomes even though they are not following the same process as their peers.(Zesski & Wedler, 2018) The PBL model allows students to contribute to their group in other ways, and encourages them to enhance the understanding of their peers through discussion and collaboration while also being exposed to experiences and conclusions they would not be otherwise able to, based upon their ability. There is always value for marginalized students when they are included in the learning process, even if they cannot fully experience everything in the course.

5.0 Universal Design Driven by Culture

5.1 Process vs Culture

Creating inclusive processes will help to make inclusivity and UD less of a job and more of a habit. UD practices seem daunting at first (especially since UDI contains 14 individual practices), but through practice and training to develop an inclusive mindset, inclusivity becomes second nature. As previously mentioned, and shown through this paper, many UDI principles work together or relate to each other, meaning that often when you make an inclusive consideration you begin to make several others simultaneously. Regularly striving to make your course materials inclusive leads to honing UD skills, causing your mindset to shift and helping you to start asking how you can make materials inclusive from their conception. The best thing you can do to make inclusivity part of your culture is to start using it. Even small steps towards inclusivity can have a large impact, and the more you engage with inclusivity and see how it helps your students the more motivated and experienced you'll become.

5.2 The Importance of a Culture of Inclusion

Creating a culture of inclusion is important for many reasons and to many individuals, opening doors and providing opportunities for many individuals to achieve their goals. Not only will a culture of inclusion increase opportunities for individuals with disabilities, but it will also create better conditions and environments for learning for all learners and instructors. Perhaps most importantly, a culture of inclusion tells learners and instructors of all ability levels and goals that they are welcome and that they can achieve their goals and will be supported and guided in the process.

5.3 Changing Culture with Faculty and Staff

Learning UDI principles and implementing them into your course materials is an important first step in changing the culture of faculty and staff (Burgstahler, 2020, pp. 184-185). Practicing what you preach and setting the example will show other instructors that UDI is possible, and the success in the classroom that results from implementing UDI principles will gather interest among other instructors and faculty members (Burgstahler, 2020, pp. 184-185). Also, learning UDI principles, practicing them, and becoming familiar with them, will help other instructors feel safer and more confident implementing them as they know they'll have someone to go to if they need help or support (Burgstahler, 2020, p. 184). This opens the door as well to implementing an inclusion department or organizing a group at the institution dedicated to training and supporting inclusion practices (Burgstahler, 2020, p. 184).

Framing UDI as beneficial to all students may also encourage apprehensive faculty members and instructors to investigate

principles. Alongside this, framing UDI as an easier approach to creating course materials and reducing the need to change (or remediate) course materials for possible accommodations (since materials will be made inclusive from inception) may help change the culture at institutions. A great way to change the culture and reduce apprehension about UDI is to be clear in the idea that UDI seems complex and difficult at first, but the more one uses UDI principles, the easier creating inclusive documents will become.

6.0 Conclusion

Education, at its core, is driven by a goal to increase the understanding and knowledge of anyone who wishes to learn. To further this goal as educators, we should make every effort to ensure our teaching practices consider every student that may enter our classroom, regardless of their physical, mental, or social ability. By adopting Universal Design for Instruction principles, it helps us make our coursework and lesson plans inclusive for every classification of student before they attend our course. By striving to make our learning environments cultures of inclusion rather than just as-needed accommodations, we promote education to students that have previously felt excluded, under-motivated, or under-valued in their education careers.

For technology educators specifically, we hope this assessment has shown that Project Based Learning (PBL) is an innovative and effective technique for the technology classroom. While there can be shortcomings in its inclusion for some students, PBL can be highly effective at keeping students engaged and learning who do not respond well to classical teaching techniques. With some adjustments and the application of UDI principles, PBL can be an effective lesson plan for adapting our learning environments for

students from every walk of life. The continued growth of our culture rests on the scientists, technologists, engineers and mathematicians of the future, those students we are educating right now. We should take every effort to make our courses inclusive, because everyone should have a chance to help build the future.

References

- Birney, A. (2020). WCAG version history. Accessible Web. <https://accessibleweb.com/wcag/wcag-version-history/#:~:text=In%20May%201999%2C%20the%20Web,A%2C%20AA%2C%20and%20AAA>**
- Bloodhart B., Balgopal M. M., Casper A. M. A., Sample McMeeking L. B., Fischer E. V. (2020) Outperforming yet undervalued: Undergraduate women in STEM. PLoS ONE Vol 15 (issue 6). <https://doi.org/10.1371/journal.pone.0234685>**
- Brinkerhoff, J., & Glazewski, K. (2004). Support of expert and novice teachers within a technology enhanced problem-based learning unit: a case study. International journal of earning technology vol 1 (Issue 2).**
- Brinkworth, C. S. (2016). From chilly climate to warm receptions: Experiences and good practices for supporting LGBTQ students in STEM. CGU Theses & Dissertations (Paper 97). http://scholarship.claremont.edu/cgu_etd/97**
- Burgstahler, S. (2010). Universal design in higher education. In S.E. Burgstahler & R.C. Cory (Eds.), Universal Design in higher education from principles to practice. (pp.3-21). Cambridge, MA: Harvard Educational Press.**
- Burgstahler, S. E. (2020) Creating inclusive learning opportunities in higher education: A universal design toolkit.**
- Capraro, R. M., & Capraro, M. M., & Morgan, J. R. (2013). STEM project-based learning: An integrated science, technology, engineering, and mathematics (STEM) approach. Sense Publishers. <https://link.springer.com/content/pdf/10.1007/978-94-6209-143-6.pdf>**
- Design for all foundation (2022). What is design for all?. <http://designforall.org/design.php>**

Dolmans, D. H. J. M., & Wolfhagen, I. H. A. P., & Van Der Vleuten, C. P. M., & Wijnen, W. H. F. W. (2001). Solving problems with group work in problem-based learning: hold on to the philosophy. Medical education, vol 35 (issue 9), 884-889

Filippatou, D., & Kaldi, S. (2010). The effectiveness of project-based learning on pupils with learning difficulties regarding academic performance, group work and motivation. Internal journal of special education, vol 25. <https://files.eric.ed.gov/fulltext/EJ890562.pdf>

HQPBL (2022). Partners, <https://hqpbl.org/partners/>

Nepomuceno, G. M., & Decker, D. M., & Shaw, J. D., & Boyes, L., & Tantillo, D.J., & Wedler, H. B. (2016). The values of safety and practicality: Recommendations for training disabled students in the sciences with a focus on blind and visually impaired students in chemistry laboratories. Journal of Chemical Health & Safety 23 (issue 1). P. 5-11

Nikischer, A. B. (2013) Social class and the STEM career pipeline: An ethnographic investigation of opportunity structures in a high-poverty versus affluent high school. State University of New York at Buffalo ProQuest Dissertations Publishing. <https://www.proquest.com/docview/1459753763?pq-origsite=gscholar&fromopenview=true>

Simmons, P. (2020). The evolution of universal design: A win-win concept for all. Rocky Mountain ADA. <https://rockymountainada.org/news/blog/evolution-universal-design-win-win-concept-all#:~:text=The%20concept%20of%20Universal%20Design%20is%20credited%20to%20Mace%20but,known%20as%20curb%20cuts%20today>

Singh, R., & Singh, H., 2011. A Novel Blend of PBL and Traditional Study in Microprocessor Course, ResearchGate.com <https://www.researchgate.net/profile/Rajvir-Singh->

***5/publication/269874297_A_Novel_Blend_of_PBL_and_Tradition
al_Study_in_Microprocessor_Course/links/54987e130cf2519f5a1
de5d1/A-Novel-Blend-of-PBL-and-Traditional-Study-in-
Microprocessor-Course.pdf***

***South Dakota Department of Education (2022). Introduction to
Technology Education, <https://doe.sd.gov/cte/documents/UP-IntroTech.pdf>***

***Stephano, P. (2011) The wheelchair woodworker shop. Woodcraft
Magazine (Issue 44).
https://www.woodcraft.com/blog_entries/the-wheelchair-woodworker-shop***

***Zesski, J., & Wedler, H. (2018). Best practices for accommodating
hearing and visual disabilities in the laboratory. ACS symposium
series, vol 1272. P. 77-88.
<https://pubs.acs.org/doi/abs/10.1021/bk-2018-1272.ch006>***



Cara Idol

My name is Cara Idol. I am the Instructional Designer of Accessibility and Universal Design in eLearning and an instructor of Multimedia and Teaching and Learning online at Arapahoe Community College. I have an AA in music and a BFA in studio arts, and I will begin work on a master's degree in the fall. I am passionate about my family, pets, animal rights, civil rights, music, art, health care, and education. Oh, and laughing!

Digital Accessibility as Curriculum

Cara Idol



If there are graduate or undergraduate programs or college courses for digital accessibility, I have not found one. My place of employment, Arapahoe Community College (ACC), offers a class MGD 1041, Web Design One, where the extent of the digital accessibility curriculum is wanting. The Colorado Community Colleges Common Courses Standard (CCCS) outcomes regarding digital accessibility (say that three times fast) that the schools must meet under the CCCS outcome are:

- ***Page layout/page design***
 - ***Usability***
 - ***Accessibility***
 - ***World Wide Web Consortium (W3C) compliance***
- ***Site functionally***
 - ***Principles of Americans with Disabilities Act (ADA) Standards for Accessible Design***

The instructor for Arapahoe Community College's MGD 1041 asynchronous course meets these criteria, with three lecture slides and links to the [World Wide Web Consortium \(W3C\)](#).

However, there are no activities or assessments given regarding digital accessibility. Other than some HTML coding, which includes accessible attributes.

I recently asked students in my multimedia class what they knew about digital accessibility. They were familiar with the concept but unaware of its applications.

Those who seek a robust education in digital accessibility must hunt for opportunities. We must look for and become members of communities devoted to accessibility, such as the [International Association of Accessibility Professionals \(IAAP\)](#).

A11y & POUR

In ACC's MGD 1041, the instructor does not mention a11y. Yet, a11y is a crucial term, concept, and movement in web designing and programming. A11y is an acronym for "accessibility." The 11 is the number of letters in the word accessibility (The A11Y Project, n.d.).

POUR is an acronym for four high-level principles that describe functional accessibility. Accessible technology is Perceivable, Operable, Understandable, and Robust. We can achieve the most accessibility by applying the POUR principles. POUR is at the heart of a11y (World Wide Web Consortium, n.d.).

Perceivable

We must present information and elements of the user interface in a way that can be perceived by the senses so that nothing is undetectable or invisible. Web usability is based primarily on visuals, but sound and touch are used instead for those unable to take visual cues.

Operable

The interactive elements, such as controls, buttons, and navigation, should be operated physically by clicking, touching, swiping, and rolling. Alternatively, we should provide voice commands or assistive devices like head wands and eye trackers.

Understandable

Technology should be presented and used clearly and consistently, with predictable patterns of use and design. The end-user should understand the meaning and purpose of the information presented in the content while understanding the user flow and interaction of the interface.

Robust

Content must be robust to work reliably with various technologies, including assistive devices.

What is Accessibility

Accessibility refers to designing devices, products, and environments to remove barriers (Henry et al., 2014).



Accessibility is the “ability to access” and benefit from some system or entity. The concept focuses on enabling access for people with disabilities or enabling access through assistive technology; however, research and development in accessibility benefit everyone (Holmes, K., 2018).

Accessibility goes hand in hand with universal design, creating products usable by people with the broadest possible range of abilities, operating within the broadest possible range of situations (Holmes, K., 2018). But, again, this is about making things accessible to everyone, whether they have a disability or not (Holmes, K., 2018).

Examples of Accessibility and Universal Design:

- ***Ramps as an alternative way of accessing a staircase***
- ***Braille on room signs and elevators***
- ***Flat light switch (Can be operated with one hand, without tight grasping, pinching, or twisting.)***

What is Digital Accessibility

“Digital accessibility refers to the inclusive practice of removing barriers that prevent interaction with, or access to websites, digital tools, and technologies, by people with disabilities” (Georgetown Law, n.d., para. 1).



Technology and the internet are essential to modern daily life; we must design digital content to be understood by the broadest possible audience (The A11Y Project, n.d.).

Digital content includes (but is not limited to)

- ***Electronic documents***
- ***Websites***
- ***Software and hardware***

- **Video and audio**

Societal Benefits



Society has benefited from accessibility. As a result, much of the invented assistive technology has become staples in most of our lives.

The typewriter was a complete game-changer for most cultures. The first version of a typewriter was the Hansen Writing Ball. The inventor, Mr. Malling-Hansen, the Principal at the Danish Royal Institute for the Deaf, invented it as a communication device for his students (Steenhout, 2010).

Telephone and texting

“In an 1894 address in Boston, inventor Alexander Graham Bell told a crowd at the Horace Mann School for the Deaf that his telephone “was a failure...[as] it did not enable the deaf to see speech as others hear it” as he had originally intended” (5 Pieces of Tech That Changed the World, n.d., para. 5).

While the telephone initially only benefited the hearing community, inventions have expanded the depth of phone accessibility since then. For example, in 1964, scientist Robert Weitbrecht invented the teletypewriter (TTY) that transmitted typed messages via the phone (5 Pieces of Tech That Changed the World, n.d.)

Today's smartphones have text messaging and include video capability to allow for signed communication—finally enabling people with little to no hearing to “see speech” as Bell initially intended for his famous invention (5 Pieces of Tech That Changed the World, n.d.).

Digital INCLUSION and UDL

“Accessibility is important. Inclusion is essential” (The A11Y Project, n.d., para. 5).



Both Digital Accessibility and Universal Design for Learning (UDL) focus on inclusive educational practices. Ensuring all students (including those with disabilities) have access to content while providing multiple options to acquire information is key to student success (Holmes, 2018).

According to the **Higher Education Opportunity Act of 2008** (HEOA), UDL:

- 1. Provides flexibility in presenting information, how students respond to or demonstrate knowledge and skills, and how students are engaged.*
- 2. Reduces barriers in instruction, provides appropriate accommodations, supports, and challenges, and maintains high achievement expectations for all students, including students with disabilities and students with limited English proficiency.*

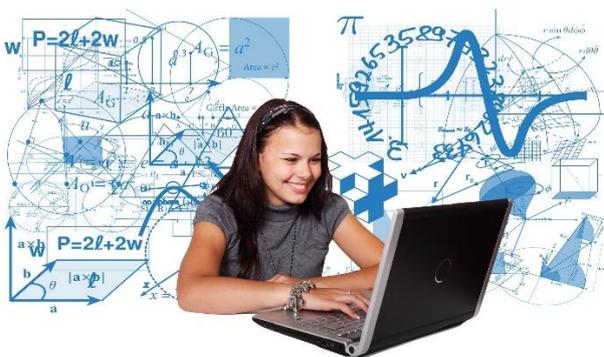
Lawsuits Create Jobs



Digital accessibility lawsuits increase each year, as are digital accessibility jobs. For example, Americans with Disabilities litigators across the U.S. filed about 15% more digital accessibility lawsuits than in 2020—equating to more than ten lawsuits per day (Mcelaney, 2022).

In 2021, most website accessibility lawsuits specifically cited Web Content Accessibility Guidelines (WCAG) success criteria to highlight the impact of accessibility barriers. The bad news: 97.4% of the top one million web pages on the internet have detectable WCAG 2.0 failures, per an analysis from the non-profit Web Accessibility In Mind ([WebAIM](#)) (Mcelaney, 2022).

Digital Accessibility Career Opportunities



With accessibility knowledge and practices continually rising, students with an intricate understanding of digital accessibility,

section 508, and ADA compliance increase graduates' marketability and salary potential. Glassdoor recruiter website reports that the U.S. median salary for an accessibility programmer is \$138K (2021). Furthermore, Comparably, a comparison website states that in Denver, Colorado, United States (where I reside), the average accessibility tester salary is \$141K, compared to the United States average of \$105K (n.d.).

The number of job listings with "accessibility" in the title grew 78% in the year ended in July from the previous 12 months, LinkedIn said in response to a data request from The Wall Street Journal (Alcántara, 2021). According to the professional networking site owned by Microsoft Corp, such listings had risen 38% between August 2019 and July 2020 compared with the previous year (Alcántara, 2021). As of January 27, 2022, ZipRecruiter had nearly 45,000 positions referencing web accessibility. In addition, LinkedIn had over 3,100 jobs for web accessibility personnel (Alcántara, 2021). The need for employment in digital accessibility continues to increase (Alcántara, 2021).

The A11Y Project, (n.d.) a community-driven effort to make digital accessibility easier, states, "Accessibility work is often done after the fact to great expense. Inclusivity asks people making digital experiences to consider early what barriers and biases might keep people from being present and what they can do about it" (para. 6). There is vast career potential in creating new accessible websites and remediating ones that are not.

Real World Instance



Ron Smith is an online banking IT Scrum Master for U.S Bank and lives in Colorado, United States. For the past year and a half, a large part of his focus has been on a11y.

Ron states that his team was initially made aware of a11y about two years ago and became a priority six months later. “Suddenly, they started saying, you need to develop a remediation plan and give us progress reports, use these tools and do all this testing,” stated Ron.

Ron continued, “I don’t think there were threats of lawsuits. But I do think that there was probably awareness of the potential. Maybe there were lawsuits in the industry that got somebody’s attention at other institutions that made us take notice.”

With U.S. Bank having such a gargantuan employee roster, Ron is unaware of all the job positions and the corresponding responsibilities. Ron stated, “I don’t know if that’s their full-time job. But there are a couple [of] people that [it] seems to be, and people from our user experience department play a big role in a11y because it falls into the user experience umbrella.”

Degrees that contain a11y curriculum are essential because there are not enough professional development opportunities. The training Ron and his team received are minimal at best. “When it first became a big priority, [U.S. Bank] gave us access to Deque University. But that was it.”

Conclusion

We are doing a disservice to our students (and society) by not providing comprehensive education on ADA, Section 508, a11y, WCAG, and POUR. Overall, individuals who already have a career in web design are familiar with digital accessibility and are becoming increasingly so. Therefore, to ensure our students are equipped and valuable, we must ensure they have digital accessibility expertise.

We can increase our students’ career opportunities and salary potential and enjoy a creative career positively affecting society. Let’s give them the skills to do so.

Cara Idol is the Instructional Designer of Accessibility and Universal Design at Arapahoe Community College in Colorado, United States. Cara also teaches Multimedia and Teaching and Learning Online.

References

5 Pieces of Tech That Changed the World. (n.d.). ai media. Retrieved March 29, 2022, from <https://www.ai-media.tv/ai-media-blog/5-pieces-of-tech-that-changed-the-world/#:~:text=In%20an%201894%20address%20in,as%20he%20had%20originally%20intended.>

Alcántara. A.M. (2021, September 1). More Companies Are Looking to Hire Accessibility Specialists. The Wall Street Journal. <https://www.wsj.com/articles/more-companies-are-looking-to-hire-accessibility-specialists-11630501200>

Colorado Community College System (CCCS). (n.d.). Common Course Numbering System. Retrieved April 8, 2022, from https://erpdnssb.cccs.edu/PRODCCCS/ccns_pub_controller.p_command_processor?pi_search_type=SB_COURSE&pi_subj_code=MGD&pi_crse_num=1041&pi_archive_date=&pi_course_status=A&pi_term_code=202320

Glassdoor. (2021, December 13). Accessibility Developer. Retrieved March 29, 2022, from https://www.glassdoor.com/Salaries/accessibility-developer-salary-SRCH_K00,23.htm

Georgetown Law. (n.d.). Digital Accessibility. Retrieved April 8, 2022, from aw.georgetown.edu/your-life-career/campus-services/information-systems-technology/digital-accessibility/#:~:text=Digital%20accessibility%20refers%20to%20the,technologies%2C%20by%20people%20with%20disabilitie

Henry, S. L., Abou-Zahra, S., & Brewer, J. (2014). The Role of Accessibility in a Universal Web. Proceeding W4A '14 Proceedings of the 11th Web for All Conference Article No. 17. ISBN 978-1-4503-2651-3.

Holmes, K. (2018). *Mismatch: How Inclusion Shapes Design*. The MIT Press.

Mcelaney, J. (2022, January 3). *Accessibility in the News, Legal Edition: Updates on ADA Title III News and More*. Microassist. <https://www.microassist.com/digital-accessibility/accessibility-news-legal/>

Steenhout, N. (2010). *The Evolution of Assistive Technology into Everyday Products. Part of a Whole*. https://incl.ca/the-evolution-of-assistive-technology-into-everyday-products/#_Toc271101948

The A11Y Project. (n.d.). *All About this Project*. a11y project. Retrieved April 8, 2022, from <https://www.a11yproject.com/about/>

World Wide Web Consortium (W3C). (n.d.). *Accessibility Principles*. W3C. Retrieved April 14, 2022, from <https://www.w3.org/WAI/fundamentals/accessibility-principles/>



Taylor McGrew

Taylor McGrew works at ACC in the eLearning Department and has worked in eLearning and Instructional Technology in various roles including OER Accessibility Specialist, Educational Technologist and eLearning Assistant since 2017. Taylor graduated with his Associate of General Studies degree from ACC in May 2022. He enjoys technology and programming and plans to achieve his bachelor's degree in Computer Science in the future. Taylor also enjoys Apologetics and hopes to one day work towards a Master of Divinity in Apologetics and Ethics at Denver Seminary. Taylor is passionate about Accessibility and Universal Design and hopes to continue helping people improve their accessibility practices and help to create a world where anyone can achieve their goals, regardless of ability.

Including Inclusion

Guiding Instructors on Universal Design

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Keywords:

Universal Design, Remediation, Inclusion, Pedagogy

Definitions:

Universal Design of Instruction (UDI) – Universal Design of Instruction (UDI) is the design of instruction that can be used by all students without the need for adaption. This design includes instructional materials, facilities, and strategies (Burgstahler, 2010).

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Introduction and Purpose

What's this guide all about?

Universal Design (UD) is a fundamental aspect of accessibility and inclusion practices. Through Universal Design and its various counterparts, we can create a more inclusive world that provides the same opportunities to any individual, regardless of ability. We can accommodate for varying levels of ability in our work and in the pieces of media we offer, and we can broaden our audience by thinking of different ability levels while creating our works, creating with accessibility in mind. When it comes to teaching UD principles, the principles themselves are no less important. Often, when providing materials to guide educators or workers in Universal Design practices, we can forget to make these materials Universally Designed themselves. We can end up creating an article or training document that teaches universal design practices in a singularly designed way, alienating individuals that may be the most passionate about the document that we've created. It's important that we don't forget why we are teaching Universal Design to others, to help provide equal opportunities to everyone, regardless of ability. This guide will seek to help you create multiple forms of media that are themselves Universally Designed.

This guide will focus primarily on digital media. While Universal Design extends beyond digital formats, even to changes in the physical world, digital mediums are some of the most impacted areas when creating Universally Designed media. Many of the tips and principles outlined in this guide will be aimed towards media created for digital use. Some of the tips and principles in this guide will also extend beyond the digital realm,

and if this is the case these tips will be marked accordingly. This guide will touch on physical media such as print sources, and concepts such as designing physical spaces for learning, but we will spend most of our focus on the digital medium.

Refresher

Universal Design Principles

The best place to start would be refreshing on Universal Design principles. Sheryl Burgstahler in her book *Creating Inclusive Learning Opportunities in Higher Education: A Universal Design Toolkit* discusses that 7 Universal Design (UD) Principles, 3 Universal Design for Learning (UDL) principles, and 4 Web Content Accessibility Guidelines (WCAG) principles make up the total Universal Design for Higher Education (UDHE) framework (Burgstahler, 2020, p. 43). While this guide is designed for anyone, including those not in higher education fields, UDHE is a great framework to build upon for any media you create or teaching that you do. Burgstahler lists these rules as follows, for Universal Design:

1. Equitable use
2. Flexibility in use
3. *Simple and intuitive*
4. *Perceptible information*
5. *Tolerance for error*
6. *Low physical effort*
7. *Size and space for approach and use (Burgstahler, 2020, p. 43)*

For Universal Design for Learning, Burgstahler lists the following:

1. *Multiple means of engagement*
2. *Multiple means of representation*
3. *Multiple means of action and expression (Burgstahler, 2020, p.43)*

Finally, for Web Content Accessibility Guidelines, Burgstahler lists:

1. *Perceivable*
2. *Operable*

3. Understandable

4. Robust (Burgstahler, 2020, p.43)

With 14 total principles to keep track of and be concerned with it can be easy to forget to account for or overlook some principles when creating media. As we continue through this guide, we'll see many practical ways to include these principles in media, and how many of these principles interconnect, so that we can multitask and "kill two birds with one stone".

Creating a Universally Designed Document

How to Make an Accessible Document from Scratch

Often when creating documentation or writing for other instructors or individuals to teach them about Universal Design principles, we end up creating documents that are themselves not Universally Designed. We should aim to make everything we create Universally Designed, so that no one is unable to access our content. But how does one create an accessible document? Do we need to account for and accommodate for every possible disability? As Sheryl Burgstahler mentions in her book, we can attempt to accommodate for as many disabilities as possible, and we can create media that is as universally designed as possible, but even if we do both things, we still will not eradicate the need for accommodations (Burgstahler, 2020). Accommodations are special privileges or changes given to meet certain needs for people with disabilities (Lee, 2019). Still, though, we can design our media with the intent to avoid accommodations as much as possible and to preemptively accommodate for the widest audience possible (Burgstahler, 2020). To create an accessible document, make sure you account for the following practices if applicable:

1. Meaningful alternative text (alt text)

2. *Meaningful hyperlinks*
3. *Color contrast*
4. *Correct heading levels*
5. *Accessible tables*
6. *Accessible lists*

One should also note that though Universal Design does work together with accessibility, it is only part of accessibility goals and practices, and should not be confused with accessibility. As we investigate creating an accessible document, it is important to make this distinction, and to remember that though a document may be Universally Designed, this does not necessarily mean the document will also be accessible, and vice versa. This does not mean we should avoid one or the other, just that we should be careful to consider all practices and guidelines when trying to make our materials as inclusive as possible.

Alternative Text

With alternative text (often referred to as “alt text”), we notice the stipulation of “meaningful”, but what does that itself mean? What makes alt text meaningful, and what does good and bad examples look like? Why do we care about alt text at all? Alt text is important to provide sight-impaired audiences with the information we’re trying to convey when using images. Screen readers will denote an image as an image but won’t describe what the image is or what it’s trying to convey unless we use alt text (*Accessibility: image alt text best practices, 2021*). Siteimprove calls these kinds of images “informative images” and describes them in this way: “Informative images are any images that add to the context of a page. If the content of a page would suffer if an image was removed, then that image is informative and therefore needs an alt text.” (*Accessibility: image alt text best practices, 2021*). Siteimprove also suggests making your alt text less than 100 words, and that if you need to write more than that you

should consider placing what your image conveys in the content around the image and using a shorter alt text for the image to compliment the text (*Accessibility: image alt text best practices, 2021*). Siteimprove also mentions that “The alt text should match the tone of voice of the accompanying content” (*Accessibility: image alt text best practices, 2021*) and “alt text does not need to be an objective description, it can convey nuances, details, and emotions if they are relevant to the user experience” (*Accessibility: image alt text best practices, 2021*). Consider these ideas when providing alt text for images in your document, what is the tone of the surrounding text, and are there any nuances or specific details I’m trying to convey through this image?

Hyperlinks

Hyperlinks can be a great way to enhance your content or connect your audience with an outside source. Hyperlinks can send audience members to locations where they can learn more about a topic or take them to a portion of a website you’re showing them how to use. Hyperlinks can also enhance your content and can often be found in reference sections or citations and can help audiences know where your information came from. However, hyperlinks can also provide barriers and challenges to accessible audiences. Inaccessible hyperlinks can be confusing and annoying when screen readers read them out, or can appear untrustworthy if described vaguely, not painting a clear picture for the audience of where they’re going. When implementing hyperlinks into our resources, we’ll want to be sure to be careful of accessibility and readability so our audience can feel safe and confident in knowing what the hyperlink is for and where it will take them.

Web Accessibility in Mind (WebAIM, 2019) suggests avoiding the following phrases as hyperlink text:

- *click here*
- *here*
- *more*
- *read more*
- *link to [some link destination]*
- *info (WebAIM, 2019)*

We can see that many of these phrases, while readable, don't accurately tell the audience where they're going, and in some cases present redundancy. "Click here" becomes redundant, since many screen readers will announce the hyperlink as a hyperlink, ending up with the audience hearing "link text, click here". (Yale University, 2022) "Read more" may make sense with surrounding context, but where will the reader go, and what exactly will they read? Are they going to a credible site that has a strong resource on the topic they're looking at, or a less credible site that only provides a cursory glance at some of the information they've already seen? We can begin to see why descriptive hyperlinks are important, audiences may become confused or nervous about clicking on a link they don't trust and can't be confident where it will lead to.

For a comparison example, these sentences would be a bad example of a descriptive hyperlink: "Arapahoe Community College offers many types of classes for many different students. [Read more here.](#)" A better version of those sentences would be: "Arapahoe Community College provides many classes for many kinds of students. Visit [Arapahoe Community College's Course Catalog](#) to see what classes are offered." Comparing these sentences together, we can see that the second sentence clearly

and quickly conveys to the audience exactly where they're going and exactly what they can expect to see. We can also see that the context is provided within the link. While we have context surrounding the link, a screen reader user who may be tabbing through objects in a document will still understand where they're going if they only read the hyperlink text.

Readability is just as important as meaningfulness. WebAIM discusses that URLs present two types of challenges:

1. *Readability*
2. *Length (WebAIM, 2019)*

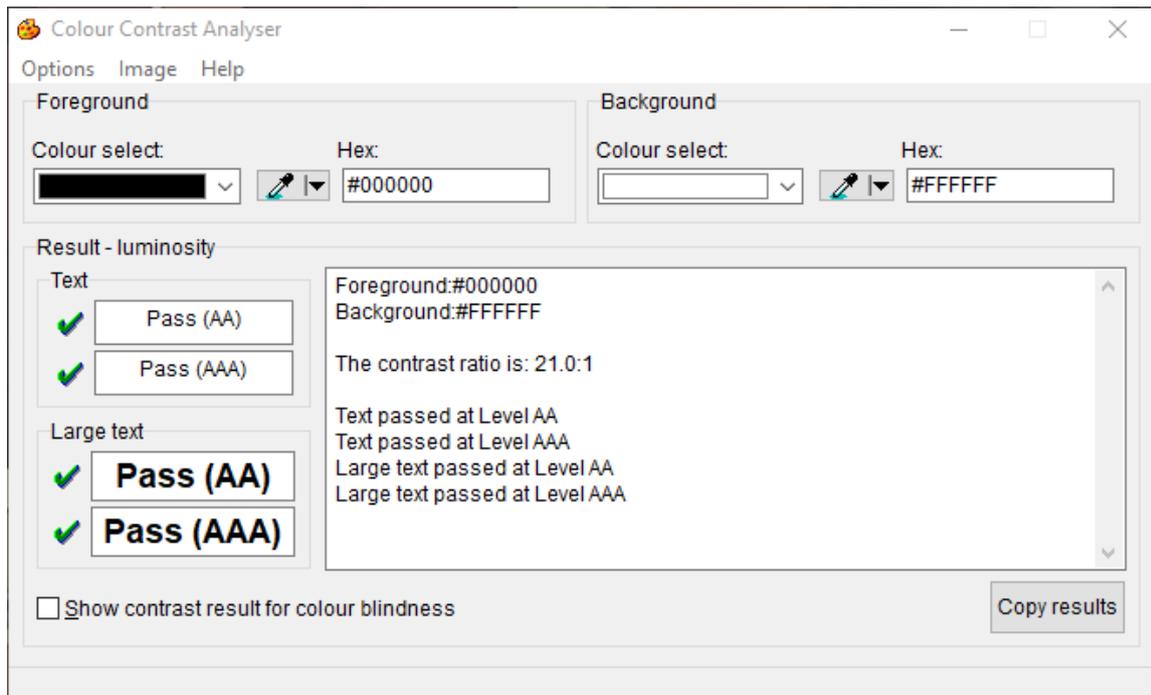
WebAIM also touches on the fact that many URLs are difficult for human readers to read, containing many random numbers, letters, and characters (WebAIM, 2019). When it comes to readability, WebAIM points out that many URLs are not readable or screen reader friendly (WebAIM, 2019). Being designed for coding and databases, URLs contain difficult combinations of letters, characters, and numbers (WebAIM, 2019). This makes for something that's difficult for sighted readers, but even more so for screen reader users, as a screen reader will attempt to read out the entire URL as it is, leading to a possibly long, annoying, and difficult to understand link experience (WebAIM, 2019). Connecting to our tips from before, this can add confusion as to where a student is going. An example of this can be seen using the link to a YouTube video. Say you wanted to provide a link in your guide that takes readers to a YouTube video on how to create an accessible PDF. A video link to that might look like this: <https://www.youtube.com/watch?v=ndNuOHeA4CI&t=73s>. A screen reader would then attempt to read the link as it sees it, reading each letter individually and each character individually (WebAIM, 2019).

This is a tamer example, but as links get longer, they become more unreadable. Even links that have descriptions of the content, such as this link:

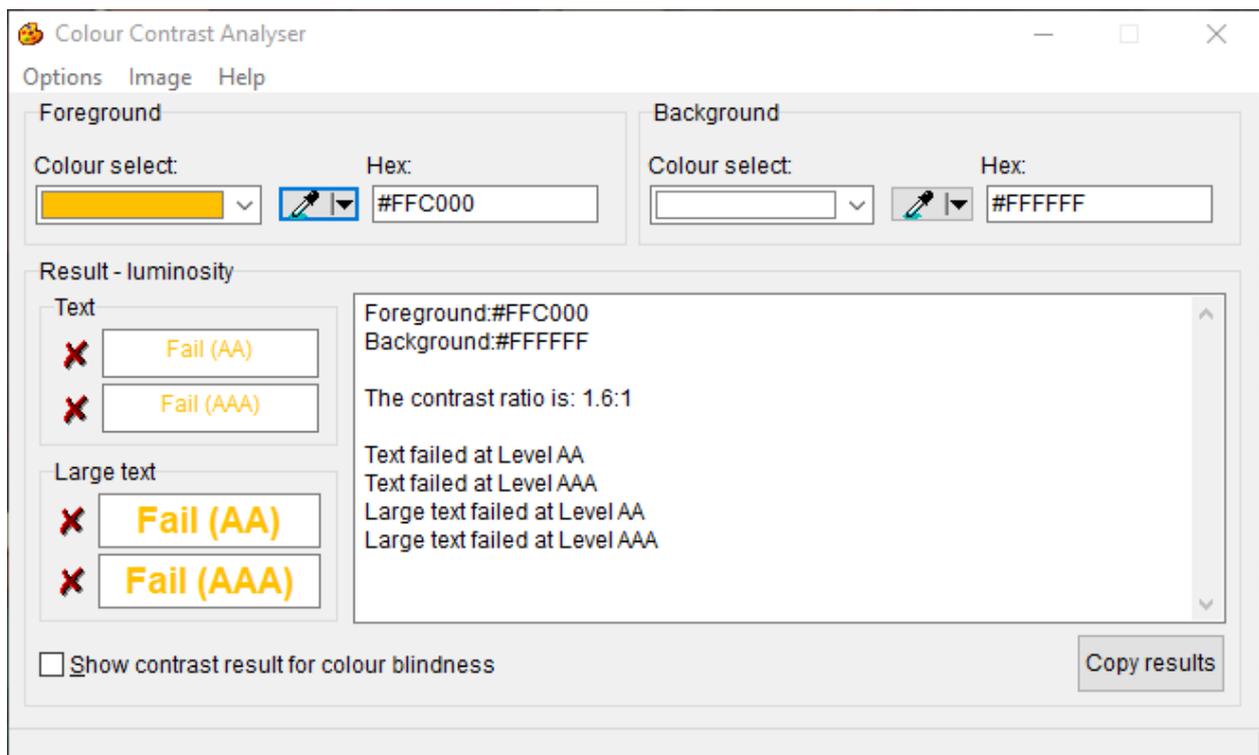
<https://www.americanprogress.org/article/ada-31-access-housing-health-care-must-meet-rise-disability-u-s/> still contain readability issues, considering that some screen readers will still read the hyphens and forward slashes (WebAIM, 2019). We can see as well from that link that some links tend to be much longer, and sometimes the accessible text we provide for links can get longer as well. WebAIM states that there “is no maximum allowable length of link text”, but that authors should focus primarily on making their links long enough to alert the user where they’ll be going (WebAIM, 2019). WebAIM also states that “as a general rule, links should be as concise as possible without sacrificing meaning” (WebAIM, 2019).

Color Contrast

Color contrast considerations are an important part of accessibility considerations. Vision impairments and color-blindness can affect how audiences interact with your media (Accessibility Guild, n.d.). The US Government’s site on Accessibility for Teams suggests ensuring that the color contrast of your text meets a standard ratio of 4.5:1 for small text and 3:1 for large text (Accessibility Guild, n.d.). The Accessibility for Teams site also suggests using WebAIM’s color contrast checker to check for this ratio (Accessibility Guild, n.d.). Here we can see what we’re looking for when using a color contrast analyzer:



We can see from this image that our black foreground and white background meet both AA and AAA standards at large and regular sizes. An example for poor color contrast would look like this. As you can see, the text is hard to make out and not easy to look at. Using a color contrast analyzer, we can see this text does not meet any accessibility standards:



The Accessibility for Teams sites also talks about using color to represent meaning in documents (Accessibility Guild, n.d.). They recommend ensuring that meaning can also be derived in other ways, such as “icons, written content, and other visual elements” to also convey meaning (Accessibility Guild, n.d.). For example, one may see instructions written as: “Complete content **outlined in red** by Thursday, and content **outlined in green** by Friday”. Instead, consider rewriting your instructions as: “Complete content **outlined in red and bolded** by Thursday, and content **outlined in green and underlined** by Friday”. The reason for multiple means of gathering meaning are for users who may be color-blind and don’t use a screen reader; a red-blue colorblind individual would not be able to differentiate the “red text” from any other text but could differentiate between bold or underlined text and normal text (Accessibility Guild, n.d.). Color contrast is also important for sighted users (WebAIM, 2021). Foreground and background colors that are similar or bright colors could present readability concerns for any user regardless of sighted ability (WebAIM, 2021). Further, a common color contrast area that creators like to use but still needs to be checked are gradients (WebAIM, 2021). Gradients can still present color contrast issues (especially as the background color becomes darker), and while WebAIM does not have specific suggestions for gradients, they do suggest testing for color contrast against the lightest point of the gradient to ensure accessible contrast (WebAIM, 2021).

Tables

Tables are a great way to provide data to users and can be a great way to show readers a large set of information in a simpler and/or more readable way. However, tables can quickly become complex and difficult to understand, especially so for screen-reader users. WebAIM discusses that “Sighted users can visually

scan a table. They can quickly make visual associations between data in the table and their appropriate row and/or column headers. Someone that cannot see the table cannot make these visual associations...” (WebAIM, 2017). With this in mind, it’s important to make sure that screen-reader users can easily and accurately navigate our tables and extrapolate the same information that sighted users can gather as well. An important concept to note as we discuss creating accessible tables is that we’ll only be touching on simple tables. Complex tables are something you may see, but are generally best avoided, as mentioned by W3C (W3C, 2019). This is because as tables become more complex, they become more difficult to make accessible and for users to understand and navigate.

Perhaps the most important aspect of an accessible table is the Table Headers. When navigating tables, it will be important for screen-reader users to understand what data the cell is referencing, which column does it belong to and which row as well? This is especially important as tables become larger and hold more information. Both W3C and WebAIM suggest ensuring that your tables have column and row headers that identify what each cell will be referencing (W3C, 2019; WebAIM, 2017). Many screen-readers will read the column and row headers before the data in the cell, helping users to know what information they’re receiving. For example, consider this table mentioning sales by individual:

Left Blank	\$2,000	\$3,000
Name	Mike	Sarah

Left Blank	\$2,000	\$3,000
Location	Denver	Los Angeles

When a screen-reader reaches the cell that crosses the two sections "Name" and "\$2000" it would read "column: \$2,000, row: name, Mike". Continuing to the next row of "\$3,000", the screen reader would read "column: \$3,000, row: name, Sarah". As you can see by the table as well, it can be a good idea to make the column and row headers bold. Also, as you can see by the table, WebAIM recommends never leaving cells in a table header empty. (WebAIM, 2017). So, what should you do if you need to leave a cell empty, or if it makes more sense for the cell to be empty rather than filled? Michigan State University recommends never leaving cells blank, and either putting "n/a" or "left blank" to indicate to screen-readers that the cell is left blank intentionally (Michigan State University, n.d.).

Another important aspect to consider with tables is a table summary. The University of Minnesota discusses that table summaries can appear as context surrounding the table or as alternative text (University of Minnesota, 2022). Just as we discussed alternative text for images earlier, tables can also have alternative text attached to them. Also, as we discussed with alt text for images, this alt text should be concise and should accurately describe what the table is meant to convey (*Accessibility: image alt text best practices*, 2021). However, Michigan State University advises against using alt text for tables except when necessary to assist assistive technology users, and instead recommends using context descriptions instead of or in

tandem with alt text (Michigan State University, n.d.). Context descriptions in this case would be describing the purpose of the table in the surrounding text of the table (Michigan State University, n.d.).

Lists

The final important consideration to make when creating an accessible document is lists. Lists can be a useful way to present connected sets of information to users and can be useful for providing steps or instructions. There are a couple different styles of lists you can choose to use to present the information you need the user to receive. However, it's important to determine what kinds of lists you need for different situations, and when each style of list works best for the content you're presenting.

The first style of list you'll use is the unordered list (W3C, 2017). These lists often appear as bulleted lists and are often used to present large sets of grouped items. An example of this style of list could be a list outlining ice cream flavors:

- *Chocolate*
- *Vanilla*
- *Strawberry*
- *Cookies and Cream*

The importance of an unordered list and the reason you would use this list style is that these items do not need to be in any specific order (W3C, 2017). For our example, it's not important if vanilla comes before chocolate, or if strawberry is the first item in the list. What we are listing is simply a group of ice cream flavors, we are only using the list to show the group in a simpler way.

The second style of list you'll use is the ordered list (W3C, 2017). In contrast to the unordered lists, these lists do show levels of importance, and it's important for the items in the list to be in the order that they are in (W3C, 2017). Using our previous

ice cream example, we can show an ordered list that lists my favorite ice cream flavors:

- 1. Cookies and Cream*
- 2. Vanilla*
- 3. Strawberry*
- 4. Chocolate*

As we can see from this list in comparison to our unordered list, our list items are numbered and appear in a specific order that is important (W3C, 2017). If we moved cookies and cream to be the last list item, and strawberry to be the first, then the list wouldn't accurately reflect what we're listing. This can be easier seen when showing steps or instructions, such as in a recipe. Imagine you created a list for making a grilled cheese sandwich, where the steps were:

- 1. Butter your bread*
- 2. Cook Bread in your pan until the bread is golden brown on both sides*
- 3. Turn the burner to medium heat*
- 4. Place cheese between bread slices*
- 5. Butter the pan*

As you can see, these steps are confusing and out of order, and would result in quite the mess of a grilled cheese sandwich. While this example seems unrealistic, this shows clearly and simply the importance of the distinction between ordered and unordered lists. If the order of the list items is important, be sure to use an ordered list, and if the order is not important feel free to use an unordered list (W3C, 2017).

Finally, the University of Colorado Boulder recommends formatting your lists correctly in the text editor you use (University of Colorado Boulder, 2021). This will identify to screen-readers that the content is designed to be a list. This can be important for screen-reader users if they're tabbing through a document, they may miss an important list if it's not formatted

correctly in the document. This also alerts screen-reader users as they're going through a document that they are about to see a list, and what kind of list they'll encounter. For example, most screen-readers will read "ordered list, list item 1" when they enter an ordered list, or conversely "unordered list, first list item" when they enter an unordered list (W3C, 2017).

Conclusion

As you can see from the content presented, there is a lot to consider when it comes to creating Universally Designed and accessible documents. However, with practice and dedication all these aspects become second nature when creating documents and materials. As you gain experience in creating documents using these mindsets, you'll start to find that it becomes easier to make documents as you include these practices, and that you don't even think about whether your lists need to be ordered or unordered, or your heading levels are correct, because you've accounted for these considerations as you've gone. You'll also find that your range of students (and the ranges of students to those you teach these practices to) may open, and that students with varying ability levels interact with your materials more fully and complete your assignments more accurately. Above all, by including these practices, you'll find that you're making an impact not only in the lives of students but your fellow instructors as well, as you work to create a more inclusive environment and provide more opportunities for success for anyone who wishes to achieve.

References

- Accessibility Guild. (n.d.). Color and contrast | visual design. Accessibility for Teams; US General Services Administration. Retrieved March 26, 2022, from <https://accessibility.digital.gov/visual-design/color-and-contrast/>**
- Accessibility: image alt text best practices. (2021, December 9). Siteimprove; Siteimprove Help Center. <https://help.siteimprove.com/support/solutions/articles/80000863904-accessibility-image-alt-text-best-practices>**
- Burgstahler, S. E. (2020). Creating inclusive learning opportunities in higher education. Harvard Education Press.**
- Lee, A. M. I. (2019, August 5). Accommodations: what they are. Understood - For Learning and Thinking Differences; Understood. <https://www.understood.org/articles/en/accommodations-what-they-are-and-how-they-work>**
- Michigan State University. (n.d.). Tables. Web Accessibility | Michigan State University. Retrieved April 16, 2022, from <https://webaccess.msu.edu/Tutorials/basics/table.html#blank>**
- University of Colorado Boulder. (2021, July 21). Lists. University of Colorado Digital Accessibility Office of Integrity, Safety and Compliance. <https://www.colorado.edu/digital-accessibility/resources/accessibility-fundamentals/lists>**
- University of Minnesota. (2022). Tables. University of Minnesota Accessible U. <https://accessibility.umn.edu/what-you-can-do/start-7-core-skills/tables#:~:text=Accessible%20tables%20are%20simple%2C%20rather,information%20contained%20in%20the%20table.>**

- W3C. (2017, April 13). Content structure. W3C Web Accessibility Initiative (WAI). <https://www.w3.org/WAI/tutorials/page-structure/content/>**
- W3C. (2019, July 27). Tables tutorial. W3C Web Accessibility Initiative (WAI). <https://www.w3.org/WAI/tutorials/tables/>**
- WebAIM. (2017, September 18). Creating accessible tables - Data tables. WebAIM: Web Accessibility In Mind. <https://webaim.org/techniques/tables/data>**
- WebAIM. (2019, October 24). Links and hypertext - Link text and appearance. WebAIM: Web Accessibility In Mind. https://webaim.org/techniques/hypertext/link_text**
- WebAIM. (2021, January 9). Contrast and color accessibility. WebAIM: Web Accessibility In Mind. <https://webaim.org/articles/contrast/>**
- Yale University. (2022). Links | usability & web accessibility. Usability & Web Accessibility. <https://usability.yale.edu/web-accessibility/articles/links>**



Lee Christopher

I am the Director of eLearning and I've been at ACC for 15 years. I have a Ph.D. in Education with a specialization in Instructional Design, a Masters of Fine Arts in Writing and Poetics (MFA) and a Masters in Education (M.Ed). My research interests center on Universal Design for Learning and how we write. I love to write and teach, and I love the world of technology. My latest publication coming out in Fall 21 is a novel, The Promoter. Cara Idol one of our Instructional Designers and our Accessibility Guru designed the cover! My most treasured time is spent with my family and my two dogs, Max and Yoda.



Stephen Knowles II

Hi! My name is Stephen Knowles II and I'm an eLearning Assistant. I'm generally the first face you see in eLearning, and I'm happy to welcome you in! I enjoy playing Magic the Gathering in my free time and co-hosting an award-winning Actual Play Table-Top RPG podcast. I also enjoy graphic design and animation, and look forward to exploring those fields more!



Soma Ghosh

My name is Soma Ghosh and I have been working in the capacity of Quality Assurance and Accessibility Specialist with the eLearning department at ACC for the past 5+ years. I came to Colorado in 2002 after spending time in Germany and India. After graduating with a Bachelor's degree (B.A) in Arts, I completed my MBA from the Institute of Management Technology. Apart from the above degrees, I am a Microsoft Certified Systems Engineer and Administrator. I enjoy working with students, faculty and staff members as eLearning continues to encourage and embrace the richness of diversity and the dignity of all persons. When I'm not working, you can find me ei-ther at home spending time with my husband, daughter and our dog, Buddy or enjoying the beautiful outdoors of Colorado.



Taylor McGrew

Hi! My name is Taylor McGrew and I'm the Educational Technologist for eLearning. I love technology, and I'm always happy to help in any way I can! I'm currently finishing my last semester at ACC and plan to graduate with an Associate of General Studies degree, and I look forward to continuing on to a Bachelor's in Computer Science. In my free time, I enjoy learning about programming and studying apologetics, and spending time with my friends and family on camping trips and road trips.



Cara Idol

Hello! My name is Cara Idol. I am the Instructional Designer of Accessibility and Universal Design in eLearning and an instructor at Arapahoe Community College. I have an AA in music and a BFA in studio arts. I am working on a Masters of Humanities, Art and Visual Media. I am passionate about my family, my pets, animal rights, civil rights, nature, music, art, and health care and education for all! Oh, and laughing!

Five UDL Strategies you can implement today!

Adapted from [Cast.org](https://cast.org) About Universal Design for Learning Guidelines & Checkpoints

*Arapahoe Community College eLearning department**

We have spent hours designing our course and creating curricula; then, we realize it is only geared to one type of learner. Following are five practices of Universal Design for Learning (UDL) that you can quickly implement to fill in some of the gaps for more inclusive learning.

Engagement



Affect represents a crucial element of learning, and learners differ vastly in their engagement or motivation to learn (Center for Applied Special Technology (CAST), 2022). “Some learners are highly engaged by spontaneity and novelty, while others are disengaged, even frightened, by those aspects, preferring a strict routine. Some learners might like to work alone, while others prefer to work with their peers” (CAST, 2022-a, para. 1). “There is not one means of engagement that will be optimal for all learners in all contexts; providing multiple options for engagement is essential” (CAST, 2022-a, para. 1).

1. Rewards



The incentive for student efforts motivates and raises their interest, participation, responsibilities, and learning. Every success story helps students become more self-confident. They are proud and encouraged to achieve another successful result (Renard, 2017).

2. Require learners to formulate and restate a goal



Some learners need support to remember the initial goal or maintain a consistent vision of the rewards of reaching that goal. For those learners, it is essential “to build in periodic or persistent ‘reminders’ of both the purpose and its value for them to sustain effort and concentration in the face of distracters” (CAST, 2022-b, para. 1).

Representation



Learning is impossible if the information is imperceptible to the learner and difficult when presented information requires great effort or assistance (CAST, 2022-c). To reduce barriers to learning, it is vital to ensure that key information is equally perceptible to all learners. “Multiple representations ensure that information is accessible to learners with particular sensory and perceptual disabilities and easier to access and comprehend for many others” (CAST, 2022-c, para. 1).

3. Customize the display of written information



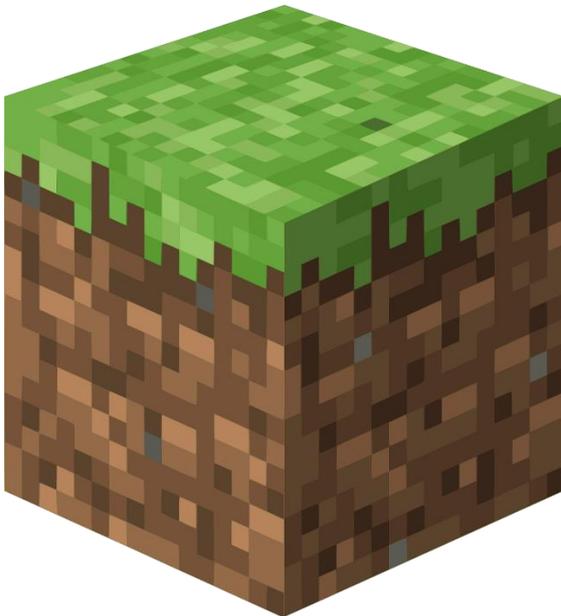
Malleable prepared digital materials can create engagement while conveying information that is. For example, a call-out box of background information may be displayed in a different location, enlarged, and emphasized using color (CAST, 2022-d). “Such malleability provides options for increasing the perceptual clarity

and salience of information for a wide range of learners and adjustments for the preferences of others” (CAST, 2022-d, para. 1).

CAST (2022-d) suggests

- **Size**
 - **text**
 - **images**
 - **graphs tables**
 - **other visual content**
- **contrast between background and text or image**
- **color used for information or emphasis**
- **layout of visual or other elements**
- **font**

4. “Chunk” information into smaller elements



Successful transformation of information into useable knowledge often requires the application of mental strategies and skills for ‘processing’ information” (CAST, 2022-e, para. 1). Well-designed materials can provide customized and embedded models, scaffolds, and feedback to assist learners with diverse abilities to summarize, categorize, prioritize, contextualize, and remember effectively (CAST, 2022-e).

calligraphy), it is important to provide alternative media for expression. Such alternatives reduce media-specific barriers to expression among learners with a variety of special needs and increase the opportunities for all learners to develop a broader range of expression in a media-rich world. For example, all learners need to learn composition, not just writing, and the optimal medium for any particular content of expression and audience” (CAST, 2022-g, para. 1).

**Arapahoe Community College eLearning department is in Colorado, United States, and they are advocates, educators, and designers of UDL and accessibility. Primary design and editing was done by Cara Idol.*

References

- Renard, L. (2017, January 25). Using reward systems to motivate students. BookWidgets Interactive. <https://www.bookwidgets.com/blog/2017/01/using-reward-systems-to-motivate-students#:~:text=Incentives%20for%20students%20motivate%20them,Being%20successful%20makes%20you%20happy.&text=Every%20success%20story%20helps%20students,to%20achieve%20another%20successful%20result>**
- Center for Applied Special Technology (CAST). (2022-a). Provide multiple means of engagement. https://udlguidelines.cast.org/engagement/?utm_source=castsite&utm_medium=web&utm_campaign=none&utm_content=aboutudl**
- Center for Applied Special Technology (CAST). (2022-b). Optimize individual choice and autonomy. <https://udlguidelines.cast.org/engagement/recruiting-interest/relevance-value-authenticity>**
- Center for Applied Special Technology (CAST). (2022-c). Provide multiple means of Representation. <https://udlguidelines.cast.org/representation>**
- Center for Applied Special Technology (CAST). (2022-d). Offer ways of customizing the display of information. <https://udlguidelines.cast.org/representation/perception/customize-display>**
- Center for Applied Special Technology (CAST). (2022-e). Guide information processing and visualization. <https://udlguidelines.cast.org/representation/comprehension/processing-visualization>**
- Center for Applied Special Technology (CAST). (2022-f). Provide multiple means of**

Action & Expression.

https://udlguidelines.cast.org/actionexpression?utm_source=castsite&utm_medium=web&utm_campaign=none&utm_content=aboutudl

Center for Applied Special Technology (CAST). (2022-g). Use multiple media for communication.

<https://udlguidelines.cast.org/action-expression/expression-communication/use-multimedia>



Imran Ahmed, Digital Accessibility Engineer

Imran Ahmed is a long-term native screen reader user as he was born blind. Throughout his life, he constantly fought and overcame accessibility challenges and misconceptions about people with disabilities. One of his motivations to migrate to the US was to acquire the necessary technical skills to make the world a more inclusive place and has served in the field of accessibility for over twelve years contributing towards this effort.



Josh Simpson, Digital Accessibility Engineer

Josh Simpson, a Deafblind accessibility engineer at United Design with a lifelong dedication to disability and space. Josh has spent decades challenging humanity and pushing the barriers to include all human beings through technology and culture.



Anna Smith, Digital Accessibility Engineer

Anna Smith is a long-time accessibility advocate. She has spent 25 years in government web design ensuring 508 compliance and an adherence to WCAG. She is constantly looking for ways inclusion, diversity, and accessibility create a better, more user-centric, design that benefits all users.



Valorie Sundby, Digital Accessibility Engineer

As a certified Principal Digital Accessibility Engineer, I believe accessibility is a journey. My mission is to illuminate the path, as we walk together to improve access to digital content for everyone. I teach others and emphasize how to fully integrate accessibility into their work. My life experience and education provide me with empathy. Walking in the shoes of others helps me to be kind, calm and compassionate. My creative avocations of photography and gardening help me be observant and open to innovation.

In our own words

Two parents with disabilities share their experience of their family experience of school during COVID

Imran

It's a little too quiet in the kids' make-shift classroom where they are supposed to be sitting listening to the teacher lecture on Zoom. Quiet children are never a good sign. At least with my children, it's a sign they have lost interest and are silently playing a game on the computer rather than attentively listening to the lesson. Sighing softly for the 20th time this morning, I go to check on them ...

The pandemic has changed our role as parents in the dance we call our educational system. Our role, once finite, has expanded to become part parent, part enforcer, part teacher, part student ourselves. It's been an adjustment as every facet of the educational system has been modified, keeps being modified, to accommodate our distance learning requirements. This has been a giant leap for all parents and educators. We have had to learn and adapt to the use of technology. We have had to change rules and protocols to create a better learning environment. Everything has changed and the learning curve is steep. For each step forward we take one or two back, and so we continue this dance between parents and teachers, all trying to provide the best possible support for our children.

However, when the technology is inaccessible, that same learning curve, can become too steep to adapt. How do we, as visually impaired parents keep up with the need for technical interaction? Is it up to us? Is it up to the school system? How do we ensure

the best education for our children within inaccessible technical scenes?

Prior to March 2020, our job, as parents was to get the children to school, provide supplies, make sure homework was done, and call them in when they were sick. Now ... we still have our duties as parents, but we're part teachers, ensuring our students are paying attention and answering questions when needed. We're part principal, enforcing rules and procedures. We're part counselors, watching for evidence of emotional stress then correcting course. No one can say our parental duties haven't increased exponentially. However, what is time consuming for most can be insurmountable for parents with disabilities who have the added hardship of maneuvering through technology that is inaccessible.

Josh

In the spirit of humanity, and an open trusting dialogue to help convey my experience, and many other experiences as valid, I want to voluntarily disclose that I am deafblind. I have a progressive blindness called Retinitis Pigmentosa. I am deaf from birth and use an assistive hearing device called a cochlear implant. [According to Wikipedia the definition of "Deafblindness" is the condition of little or no useful hearing and little or no useful sight.]

I am a deafblind parent with an autistic partner and an elementary school aged autistic student. We faced unique challenges in our household with remote education during the time of the COVID-19. While many of the challenges can be removed or mitigated with the right attitude on the part of the school district, school administrators, teachers, and staff, the school day still presents additional challenges for my student, my

partner, and me. Some of these challenges have become road blocks to providing what others may take for granted as a “normal” education.

One of these challenges is the education platform selected is in accessible in some ways to keyboard only users. The primary issue is it does not provide a visible focus indicator when the keyboard user is focused on an object on the page such as a button or link. When using a keyboard to navigate a web page, there needs to be a way to know where you are on the page. Just as mouse users can tell they are hovering over an element on the page by a change in the button or link, keyboard only users need a visual indication of where their focus is on the page. This is normally by providing a border around the focused object.

However, with this platform, as a keyboard only user, he has no idea where he is on the page. And we ask keyboard only users also are unable to know where our student is on a page when he has questions. Since my student requires keyboard accessible formats of the class assignments, readings, and other materials and these materials are not being provided in a natively accessible format, my partner and I have the added task to make them accessible.

Once we hurdle the issues in accessing the assignment, and our student completes it, we then need to upload them on the inaccessible system. This whole of process takes both of us about two hours per day whereas it may take one parent 5-10 minutes to accomplish. If the system and materials were accessible, our student would be able to work independently, or with occasional assistance, as most students do. Providing an accessible system and materials would lift a major burden from parents who are

themselves disabled and provide independence for students with disabilities.

To date, the school has been unwilling to provide the materials ahead of time. This means both parents are necessary daily to keep the student on task, convert the materials to an accessible format, provide clarity and answers while completing assignments, and aid in uploading the completed assignments. If the school delivered the materials to the parents a week ahead, we could use weekends and evenings to prepare the materials rather than consistently trying to play catch up by staying up late in order to submit completed work by the stringent due dates.

The hybrid classroom approach is difficult for a neurodivergent student to stay motivated. By adding another level of inaccessibility, it is exponentially harder for a uniquely divergent family to attain the same level of education and meet requirements in a timely manner.

Commentary

Most schools have programs to accommodate students with disabilities providing personalized help when the students are onsite in the form of teacher oversight or even a para who moves with the child from class to class. However, when the learning is not onsite, this responsibility moves to the parent. When it is the parent who has the disability, schools are generally ill-prepared to accommodate the parent or aid them in providing the same level of educational experience to their student.

The law for parents with disabilities

Knowing the laws in your country, state, and local government is the first tool you will want in your advocacy toolbox.

In the United States, both the **Individuals with Disabilities Education Act (IDEA)** the **Americans with Disabilities Act (ADA)** covers parents with disabilities.

The National Center for Learning Disabilities has a story about a parent's advocacy for themselves (**ADA Accommodations When Advocating in Your Child's School - NCLD**). This is to let you know that advocating for yourself when you are disabled is as important as advocating for your child.

"I receive accommodations at my son's school when I advocate for him. Every meeting, all written correspondence, everything must be accessible for me because of my disabilities.

Let that sink in for a minute."

Advocating to get materials early

The reasons for not wanting to provide material ahead of time range widely. There may be fear that the materials will be shared with the students (yours or friends) early giving them an advantage.

Some schools have students and parents sign an agreement for materials released early including not sharing. If a school does not have such an agreement, you can advocate for one. This way the school will know that you, the parent, are serious about respecting the wishes of the school.

Coordinate with your student's teacher or the Learning Management System (LMS) administrator for early access to materials. Ask if the LMS has a parent role or parent sign in

capability to access materials early. If not, find out if you can be enrolled as a student with early access accommodation.

This may be a new concept to the teacher or administrator so maintain a collaborative mindset while working through the details. The administrator may need to coordinate with leaders as well.

Know your accommodation needs

Knowing what you need to be successful in advocating for your student is important. People with life-long disability are likely familiar with advocating for accommodations such as recorded meetings, sign language interpreters, and large print materials. People who are new to their disability may not have figured out what they need yet. This is the first step in successful advocacy, know your accommodation needs and ask for them.

Learn from the experience of others. If you do not know other parents with disabilities, seek them out online. Find blogs and articles on how to know your accommodation needs. Learn what accommodations are available.

Here is a list of resources to help you get started:

- [**ADA Accommodations When Advocating in Your Child's School - NCLD**](#)
- [**Schools Can Accommodate Parents With Disabilities | The Mighty**](#)
- [**Helping parents with learning difficulties to speak up \(bristol.ac.uk\) \(PDF untagged\)**](#)
- [**Parents with Disabilities Have Rights - PAVE \(wapave.org\)**](#)

Patience and collaboration

Patience is hard to hold onto if your student is falling behind. Lainey Feingold, [Patience: A Negotiation \(and Accessibility\) Strategy – Law Office of Lainey Feingold \(Iflegal.com\)](#), defines "active patience" as the combination of staying calm while being persistent in solving the problem. It takes practice to stay patient while following up on communications and setting up meetings.

Lainey uses the vision of the deep sea [octopus that sits on her eggs for 53 months](#), and then dies as a metaphor for the patience it sometimes takes. Sometimes that is the kind of patience it takes.

Collaboration starts with understanding that everyone's goal is to help your student succeed. Remember that each Teacher, Principal, or administration may also have a disability (hidden or visible) and have a student at home. Look upon them as part of the team, allies with a common purpose. Taking on the collaborative mindset will help things go faster and will lay the groundwork for processes that will help every parent with a disability that comes after you.

It is exhausting to advocate for yourself, your spouse, and for your student. If you are fortunate to not have a disability, keep this exhaustion in mind. Help carry the load for someone else by being an ally. An ally is someone who steps up to help identify barriers; becomes a member of the advocacy team; and educates others about working with people with disabilities.

In summary, students with parents with disabilities can succeed. As a parent with a disability, know what accommodations you need and ask for them. For everyone, practice active patience and

follow up with communications. For everyone, help put processes in place that will help others. Be an ally by being a member of a collaborative team.

...to my surprise, this time the kids are sitting attentively, listening to the teacher tell a story that is accessible to all the children and me. I follow along on my refreshable Braille display and my child can follow along with the

what you are collecting and what you are reading as you move through the data to get a feel for what is happening within each story (p. 82).

Step One: Create Familiarity. This process was conducted by re-reading and listening to the interview recordings both while transcribing and while reading the finished transcripts. **Step Two: Create Codes.** The codes created for this data set are based on the analytical question, "What is ableism?" (discourse). Using the semantic object, a derivative of the analytical question, initial coding began. **Step Three: Create Discourses (Themes).** Once we had completed the initial coding, we began to compare my coded data against each other, grouping different statements and stories together based on similarity. Throughout this process, an in-depth research log and memo were created, annotating and listing direct quotes and exemplars, and coding statements in different colors. **Step Four: Review Discourses (Themes).** Once the discourses were named and identified, a definition with an in-depth description and exemplars were created. A review of the exemplars was necessary to define the boundaries of the discourses and to ensure that there was little to no over-lap within the tenets of the identified discourses. **Step Five: Defining Discourses (Themes).** After completing the

review of discourses, a robust, analytical memo was created outlining each tenet that constructed the discourses identified. **Step Six: Use of Exemplars.** Using exemplars for this process involved identifying specific passages of spoken dialogue from participants as they answered questions.

Verification Procedures

Although this work does not seek to predict or explain how a phenomenon works, there is an importance placed on ensuring that data is analyzed with rigor, validity and reliability in mind. To accomplish this, three different verification procedures were used. The verification process included referential adequacy, audit trail and data exemplars. In total, 32 exemplars were pulled with 11 unique, non-repeated examples that illustrate the presence of ableism in implementing UDL.

Results

To answer the research questions, themes were identified from the responses provided by the participants. These themes provide space for exploration on the role of ableism in the utilization of strategies in implementing UDL. For research question one, four themes emerged from how UDL was being implemented. They include: the use of multimedia in applying UDL principles, using the discussion tool of a Learning Management System (LMS), the creation of self-assessments and practice tests, exams and quizzes are highly used and the creation and implementation of rubrics.

The utilization of multimedia as a tool of implementing UDL was often reported as the sole task being used by instructors. This aligns with the multiple means of representation principle within UDL. The use of the LMS as a tool for creating engagement was

identified, but specifics of how the tool was used were not provided. Self-assessments, practice tests, exams and quizzes were also identified, but specifics on the implementation remained unclear and the creation and employment of rubrics echo the need for finite and tangible assessment.

The second research question provided the following themes. They include: the diversity in needs for a diverse population; challenges in communicating between instructor, students and the course materials; lack of consistency in design; and student challenges in adapting to evolving classroom environments. Additionally, there was an overarching theme across both questions of lack of support and resources available from the institution itself.

There is a level of irony present that the diversity in population emerged as the largest and most common challenge faced by course designers. Virtually every participant mentioned the challenges in



Letter from the Chairman's Desk By Sunil Bhatia PhD

I was on my morning walk and noticed school children were going to school. I thought, 'Why has school come into our lives?' Is school disciplining us? Is school designed for opening up our faculty of minds? Does the school help us in becoming civilized people? Does school help in innovations and creativity?

I was in serious thought but confusion was surfacing. How our ancestors progressed in absence of school and no concept or idea of school was not in their minds. Has the idea of school surfaced because of the need of transferring learned knowledge to future generations for their benefit for progress? Has the school of the concept come into existence for producing standard skill human beings with minimum basic knowledge for performing specific works? I think it has changed its course of action after industrial revolutions and political maturity. The political class needs standard humans for better management of controlling and governing. I failed to conclude but I was experiencing little disturbance.

I remember the statement of Aristotle that if permission is given I divide the class of the students into three levels and deliver lectures accordingly. For those who are at the bottom level of receiving knowledge, I will teach them rigorously to make them intelligent. Those who are mediocre need less attention and a few lectures to make them intelligent and those who belong to the

highest level of intelligence do not need my services of lectures. But the problem is the teacher has to treat everyone with the same lower intelligence and deliver lectures from that bottom level. The frustration Aristotle expresses is that producing the standard form of human and killing the innovations and creativity of an individual. I visited a primary school as a judge for a painting competition and found that the teacher announced the task of the painting for your drawing of the choice of house. Every child has painted a hut at the bank of the river with a small door and window, a small girl standing close to it in the background of a mountain, and two birds flying. I immediately concluded this school has killed the creativity of the individual child and succeeded in producing humans with standard thoughts.

A second question struck my mind. Does any yardstick exist for measuring human intelligence? My answer was a big no. Then what will be the mechanism for classification? When I found a student who scored just one mark less than the passing mark and received the punishment for staying in the same class for a complete year and another hand a student who scored just a passing mark was rewarded and promoted to the next level. My question is what the difference in intelligence between both students is. My answer was nothing.

The next question is what are creativity and innovations? Is it moving from the existing state to the next level in innovations? Are the things that have never been imagined or thought about before anyone but thought in the present state of creativity?

The class design has come to the existence where a person who is a teacher explains prescribed subjects from his past learning and focuses on the opening of faculty of the minds of students. A

teacher wishes to communicate with students what is in his mind and if he succeeds in it that is his success in teaching. Learning depends on communication and communication depends on language skills.

Human learning cannot be standardized. Man learns from observations and what his environment is. The child learns the language when the mother keeps repetitively speaking the same words and he tries to replicate the same. Another store of information in his mind interprets in its ways. This type of learning is by interpreting things out of learned knowledge. A person who goes out of the house is learning through his senses and the brain keeps that data. Another is sitting alone in a room and brooding for a new interpretation of a problem with his learned knowledge and there is no external information that influences his thought process. It follows no rules and comes out with new thoughts for that specific problem where no one ever thought and considered a genius. On the other hand, we design a standard environment of the school for learning and judge his retaining knowledge by giving the same environments to the students for recalling the stored information. All efforts are for standard learning to standard judgment process. In this exercise, universal design principles help create equal opportunity for everyone for the best learning.

I am thankful to Director Dr. Lee Christopher for accepting our invitation and focusing on learning with the UD principle. Any task needs attention in action in every stage to complete the task at hand and the use of UD helps in performing the task better.

Lambert Academic publication for celebration of 150th special issue by publishing a book by compiling editorials "Design For All,

Drivers of Design” translated in eight different languages from ENGLISH into French, German, Italian, Russian, Dutch and Portuguese. Kindly click the following link for book. "Morebooks", one of the largest online bookstores. Here's the link to it:

<https://www.morebooks.de/store/gb/book/design-for-all/isbn/978-613-9-83306-1>

With Regards

Enjoy reading, be happy, and work for the betterment of society.

Dr. Sunil Bhatia

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Forthcoming Issues

June 2022 Vol-17 No-6



**Mark Watson MDIA – M Des. (Industrial – By Research) RMIT –
Design Providence / DesignThinkers Group**

Founded in 1990, Design Providence is a multi disciplinary practice in the field of Interior Architecture and Product Design. Working in Service Design and Design Thinking since 2010 becoming a Partner with Amsterdam based DesignThinkers Group & Academy in 2013 facilitating rapid prototyping workshops, including the Global Goals Jam with Amsterdam University of Applied Sciences and the UNDP.

Mark held office as Vice President with the Victorian Chapter of the Design Institute of Australia, also as Director with Arts & Recreation Training Victoria, and Artists & Industry.

Mark has presented on Design in India since 2003 at Design Sutra Conference Mumbai, participated in the International Council of

Societies of Industrial (ICSID) [now World Design Organisation] Interdesign Workshop "Humanising the Metropolis" Mumbai, also presented at IIT Delhi, IIT IDC, Mumbai, NID Ahmedabad and DYPDC Center for Automotive Research & Studies, Pune as well as the NatCon InDesia in Kolhapur in 2014 for the IIID.

He is advisor to the India Design Festival, the Delhi Design Festival and Odisha Design Council as well as judge of the India's Best Design Studio / Project Awards 2017, Guest Editor of the 'Design for All of India' Journal July 2017 Vol-12 No-7 and keynote speaker at the 17th CII NID Design Summit 2017 in Hyderabad.

In 2017 participated with the Australia India Institute as Incoming Leaders Fellow researching Air Quality in Delhi incorporating World University of Design and CSIR – NEERI.

Mr. Mark Watson

***Unit 1 / 52 Fenwick Street,
Portarlington 3223, Victoria, Australia***

July 2022 Vol-17 No-7



Lourdes Arreola Prado

Built Environment Program Manager

International Association of Accessibility Professionals (IAAP)

G3ict : The global Initiative for Inclusive ICT's , USA

María de Lourdes Arreola Prado is an international consultant in accessibility, inclusion and diversity and is CPACC and CPABE (Level 1) certified. She is also a member of the International Association of Accessibility Professionals (IAAP). Lourdes is the creator and founder of Linkenium, a consulting firm through which she accompanies institutions and companies in the construction of inclusive environments. She is also a member of the Latin America Advisory Group for CBM.

Lourdes has participated as speaker, consultant and lecturer of accessibility, inclusion and diversity topics in various national and international forums. She was part of the Mexican committee to develop the accessible ICTs Standard. She has led the efforts to develop the first accessible tourist guide for Mexico City and, to enhance accessibility around all the nine buildings of ASUR's airports based in Mexico, among other projects.

In 2013 she was a finalist at Cartier Women's Initiative Awards. In 2015, she received the State Award against Discrimination, granted by the CODHEM, for promoting equality and non-discrimination in the workplace. She is an Engineer in electronics from the Universidad Iberoamericana and received a diploma as "Expert in Information Technology and Disability" by Creática Fundación FREE (Spain) and CETYS University (Ensenada, B.C.). She is multilingual in English, French and Portuguese, with solid knowledge of Italian.

August 2022 Vol-17 No-8



Prof. Dr. Jurgen Faust, PhD

Professional Experience

2021 – current Professor SRH Mobile University, Germany

2013 – 2020 President Macromedia University Munich, Germany

2010 – 2013 VP for Academic Affairs and Research, MHMK Munich, Germany

2008 – 2013 Dean, MHMK, Munich, Germany

2007 – 2021 Full Professor Media Design and Communication, Macromedia University Munich, Germany

2009 - 2012 International Strategic Advisor, Istituto Europeo di Design (IED) Group, Milan, Italy

2007 - 2009 Chief Academic Officer, IED group, Milan, Italy

2007 – 2009 Professor Monterrey Tecnológico, Monterrey, Design and Theory, Mexico

PhD, University of Plymouth, Planetary Collegium, England

Thesis title: Discursive Designing Theory, Towards a Comprehensive Theory of Design

Supervisors: Prof. Dr. Derrick De Kerkhoeve, Prof. Roy Ascott, Prof. Antonio Caronia, Prof. Mike Phillips

1982 - 1984

***Postgraduate Studies, Free Academy in Nuertingen, Germany
(painting/graphic and sculpture), Fine Arts degree
1979 - 1982***

***Undergraduate Studies, University of Applied Sciences, Reutlingen
in Cooperation with***

University of Bremen, Germany, Diploma in Chemistry (Dipl. Ing.)

Jurgen Faust (born 1955 in Germany) is a design professor, researcher who has worked in four different countries, US, Mexico, Italy and Germany as a Professor for Design, Theory and Media as well as an administrative Dean in four countries. He is a co-founder of a private university in Germany, as well as a developer of many undergraduate and graduate programs in a variety of fields in design. His PhD research was about designing design through discourse within the design community. His research work let him to create a comprehensive theory describing design processes and models.

Over the past decades he has specialized in managing through designing and published about the idea of transferring design methods and processes into the management field.

He was as well teaching design and design theory. He contributed to a variety of books and publications. In addition, he is a practicing researcher, designer, and artist, who showed in many places, including museums and galleries in Europe, Germany, France, England, Italy, Poland and Slovakia as well as the United States.

Jurgen Faust was the President Macromedia University of Applied Sciences in Munich for 8 years and since March 2021 he is a professor at SRH Mobile University Germany where he currently develops a new Design School Design focused on distance education with the master programs in Design Management and UX & Service Design.

December 2022 Vol-17 No-12



Ivor Ambrose

Managing Director, ENAT asbl.

Ivor Ambrose has worked in the areas of accessibility and disability inclusion for over 40 years as a researcher, university lecturer, project manager, policy advisor and independent consultant. Born in England, he has lived and worked in the UK, Denmark, Belgium and Greece. He holds a Master's degree in Environmental Psychology from the University of Surrey, UK and a university lecturer/Ph.D. qualification from the Danish Building Research Institute, where he specialised in User Evaluation of Environments and new Information and Communication Technologies.

In 2001 he turned his attention to accessibility in the tourism sector, which generally lacked awareness of the needs and specific access requirements of people with disabilities, resulting in inadequate provisions for these travellers. As a researcher and advocate of 'Design for All, which germinated in Europe in the late 1990s, and 'Universal Design' which took hold in the same period in USA, he was part of a movement which challenged policy makers and practitioners in many fields to re-think the way environments, products and services were conceived and designed. Through his research and observations of life, behaviour and cultures, Ivor has developed a driving ambition to make tourism accessible for everyone, everywhere.

In 2008 he co-founded the European Network for Accessible Tourism (ENAT) non-profit organisation (www.accessibletourism.org), with a group of European organisations active in the tourism industry and disability advocacy. He was elected as its Managing Director and has continued in that position since then. ENAT has become the premier membership association for about 300 organisations, business and individuals who support and want to learn more about this area of tourism development. As its director, Ivor manages ENAT's activities and projects including curriculum development and vocational training courses for hospitality management and staff, European and international standards work on accessibility and tourism, destination management consultancy, certification and provision of accessibility information through online platforms including Pantou, the Accessible Tourism Directory (www.pantou.org). The ENAT Board also maintains links with the UN World Tourism Organisation, the EU Tourism Manifesto Group, the International Social Tourism Organisation, Blue Flag International, Zero Project and many national and regional tourist bodies.

Email: enat@accessibletourism.org

Athens, April 2022

New Books



ISBN 978-613-9-83306-1



Sunil Bhatia

Design for All

Drivers of Design

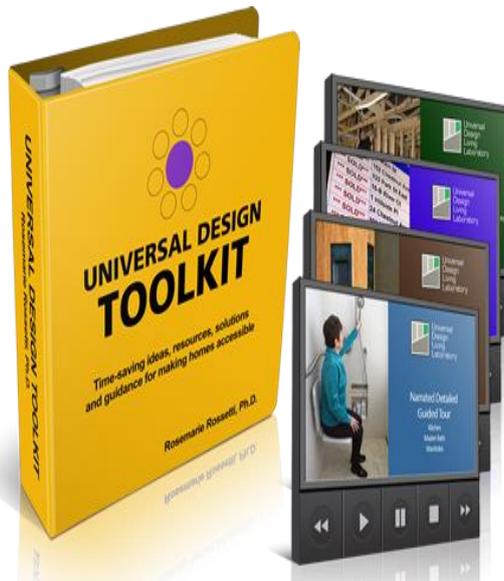
Expression of gratitude to unknown, unsung, u nacknowledged, untrained and selfless millions of heroes who have contributed immensely in making our society worth living, their design of comb, kite, fireworks, glass, mirror even thread concept have revolutionized the thought process of human minds and prepared blueprint of future. Modern people may take for granted but its beyond imagination the hardships and how these innovative ideas could strike their minds. Discovery of fire was possible because of its presence in nature but management of fire through manmade designs was a significant attempt of thinking beyond survival and no

doubt this contributed in establishing our supremacy over other living beings. Somewhere in journey of progress we lost the legacy of ancestors in shaping minds of future generations and completely ignored their philosophy and established a society that was beyond their imagination, I picked up such drivers that have contributed in our progress and continue guiding but we failed to recognize its role and functions. Even tears, confusion in designing products was marvelous attempt and design of ladder and many more helped in sustainable, inclusive growth.

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it is available on www.morebooks.de one of the largest online bookstores. Here's the link to it: <https://www.morebooks.de/store/gb/book/design-for-all/isbn/978-613-9-83306-1>

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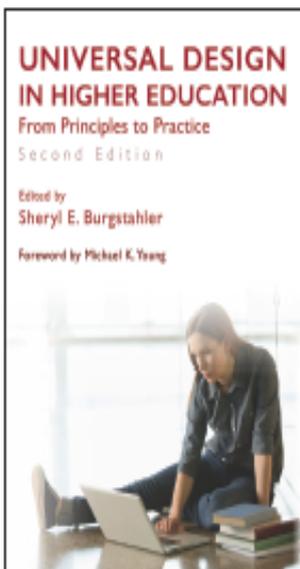
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UNIVERSAL DESIGN IN HIGHER EDUCATION

From Principles to Practice, Second Edition

EDITED BY SHERYL E. BURGSTAHLER • FOREWORD BY MICHAEL K. YOUNG

This second edition of the classic *Universal Design in Higher Education* is a comprehensive, up-to-the-minute guide for creating fully accessible college and university programs. The second edition has been thoroughly revised and expanded, and it addresses major recent changes in universities and colleges, the law, and technology.

As larger numbers of people with disabilities attend postsecondary educational institutions, there have been increased efforts to make the full array of classes, services, and programs accessible to all students. This revised edition provides both a full survey of those measures and practical guidance for schools as they work to turn the goal of universal accessibility into a reality. As such, it makes an indispensable contribution to the growing body of literature on special education and universal design. This book will be of particular value to university and college administrators, and to special education researchers, teachers, and activists.

SHERYL E. BURGSTAHLER is an affiliate professor in the College of Education at the University of Washington in Seattle, and founder and director of the university's Disabilities, Opportunities, Internetworking, and Technology (DO-IT) and Access Technology Centers.

“Sheryl Burgstahler has assembled a great set of chapters and authors on universal design in higher education. It's a must-have book for all universities, as it covers universal design of instruction, physical spaces, student services, technology, and provides examples of best practices.”

—JONATHAN LAZAR, PROFESSOR OF COMPUTER AND INFORMATION SCIENCES, TOWSON UNIVERSITY, AND CO-AUTHOR OF *EN SURE DIGITAL ACCESSIBILITY THROUGH PROCESSES AND POLICY*

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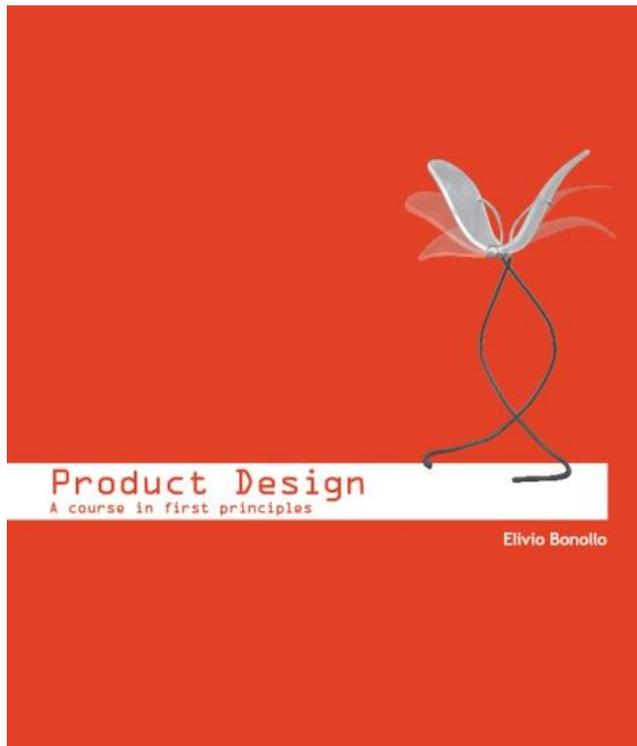
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Disability, Rights Monitoring and Social Change:



New Update: ELIVIO BONOLLO (2015/16) PRODUCT DESIGN: A COURSE IN FIRST PRINCIPLES



Available as a paperback (320 pages), in black and white and full colour versions (book reviewed in *Design and Technology Education: An International Journal* 17.3, and on amazon.com).

The 2018, eBook edition is available in mobi (Kindle) and ePub (iBook) file versions on the amazon and other worldwide networks; including on the following websites:

ePub version: www.booktopia.com.au

<https://www.booktopia.com.au/ebooks/product-design-elvio-bonollo/prod9781784562946.html>

mobi (Kindle versions): www.amazon.in

https://www.amazon.in/Product-Design-Course-First-Principles-ebook/dp/B07FNV2F4L/ref=sr_1_1?ie=UTF8&qid=1532999395&sr=8-1&keywords=Product+Design%3A+A+course+in+first+principles

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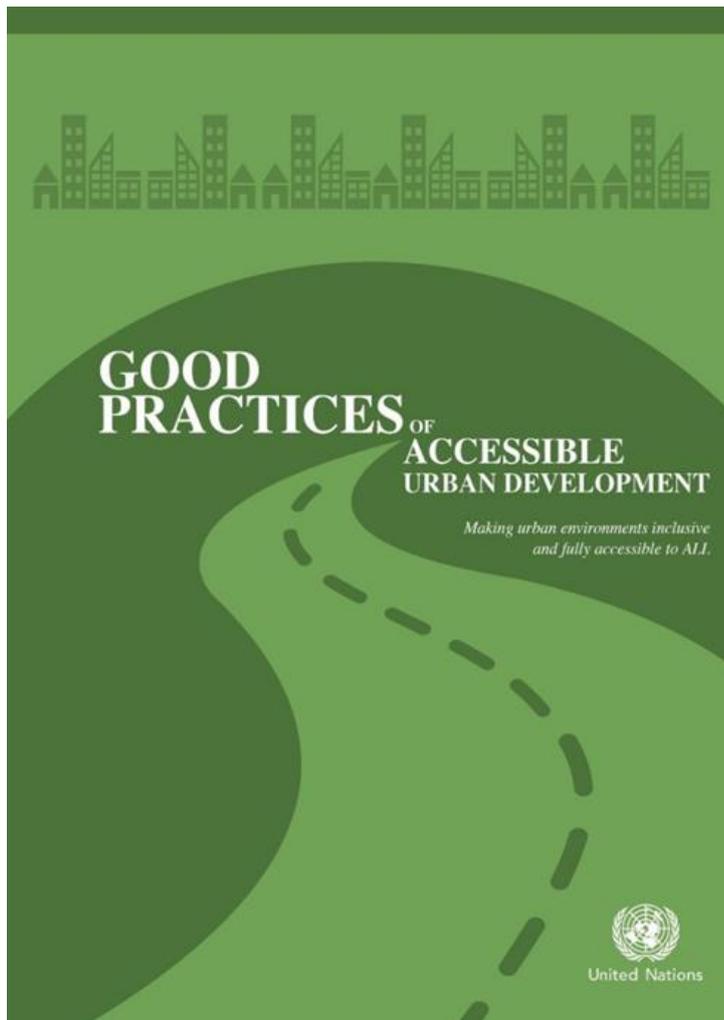
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INCLUSION



BRANDING

Revealing Secrets to
Maximize ROI

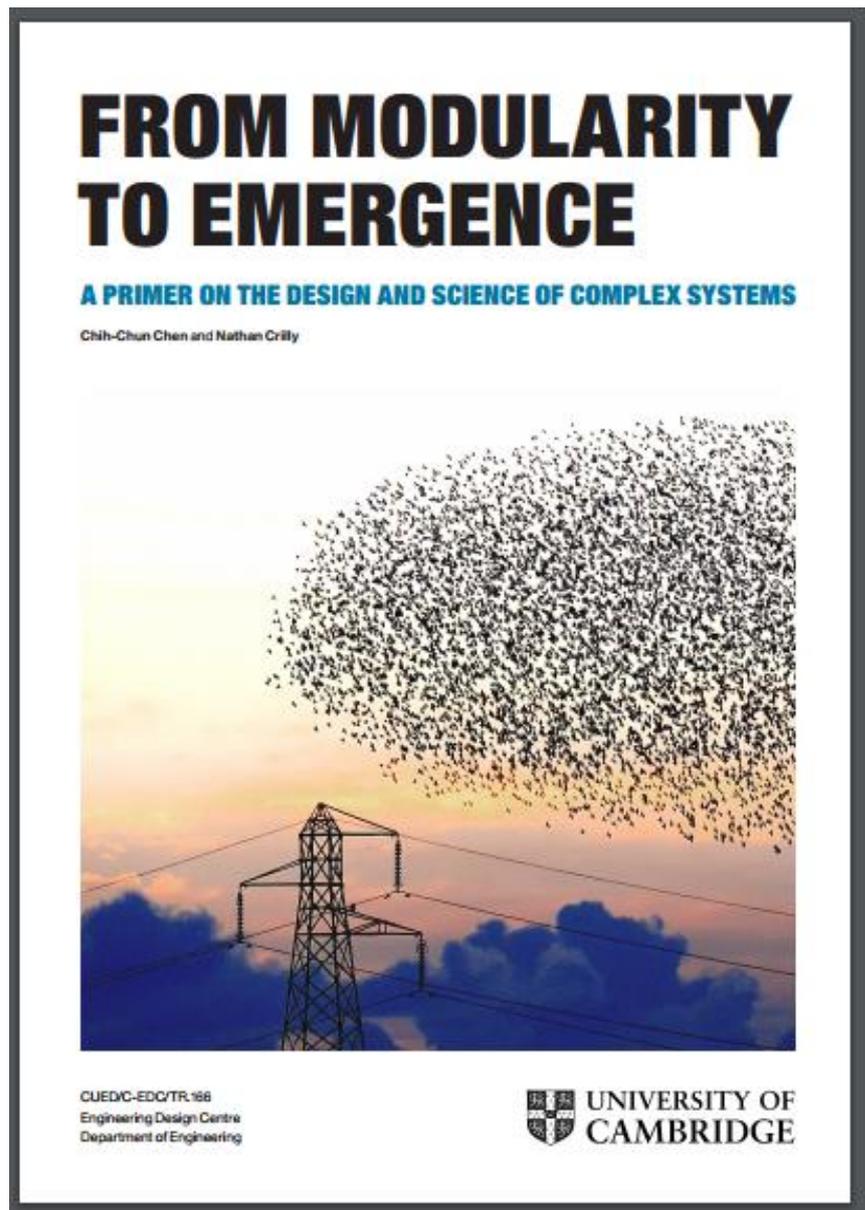


In light of the forthcoming United Nations Conference on Housing and Sustainable Urban Development (HABITAT III) and the imminent launch of the New Urban Agenda, DESA in collaboration with the Essl Foundation (Zero Project) and others have prepared a new publication entitled: "Good practices of accessible urban development".

The publication provides case studies of innovative practices and policies in housing and built environments, as well as transportation, public spaces and public services, including information and communication technology (ICT) based services. The publication concludes with strategies and innovations for promoting accessible urban development.

The advance unedited text is available

at:http://www.un.org/disabilities/documents/desa/good_practices_urban_dev.pdf



Dr Chih-Chun Chen and Dr Nathan Crilly of the Cambridge University Engineering Design Centre Design Practice Group have released a free, downloadable book, A Primer on the Design and Science of Complex Systems.

This project is funded by the UK Engineering and Physical Sciences Research Council (EP/K008196/1).

The book is available at URL: <http://complexityprimer.eng.cam.ac.uk>

Changing Paradigms: Designing for a Sustainable Future

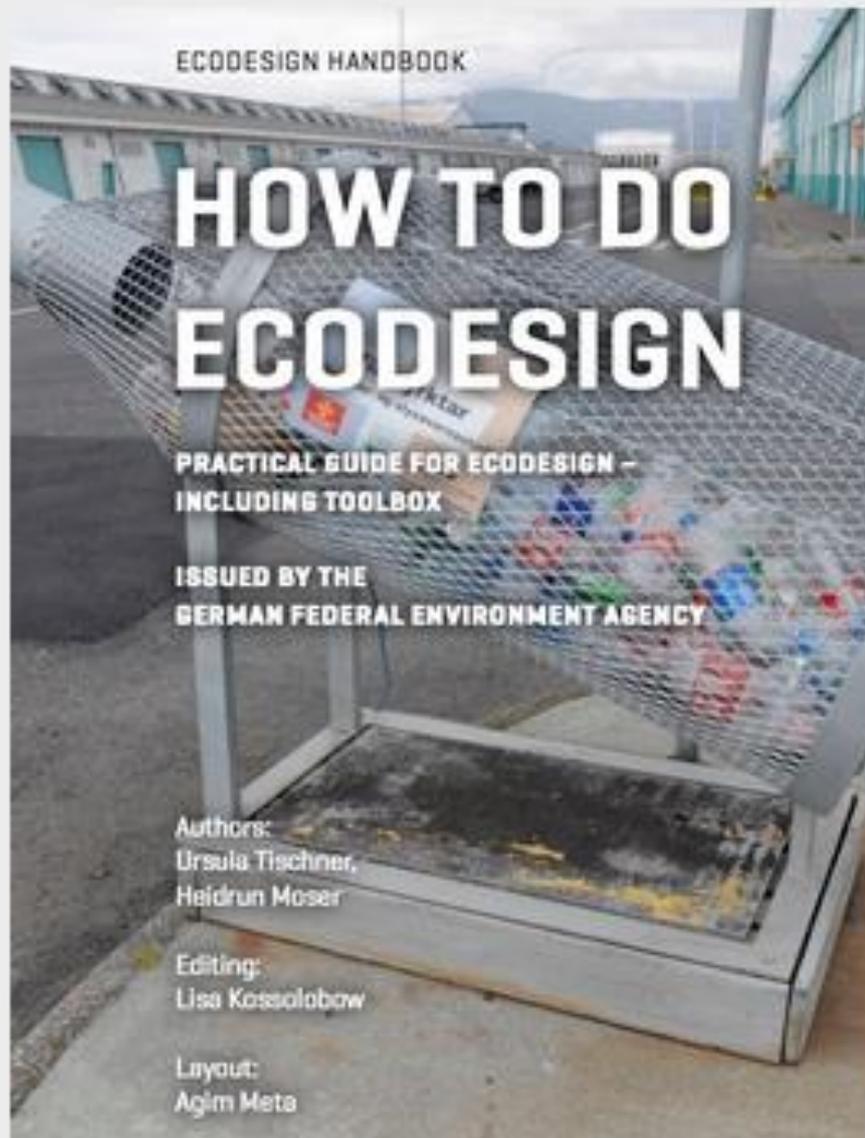
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Art, Design and Media



New iBook / ebook: HOW TO DO ECODESIGN

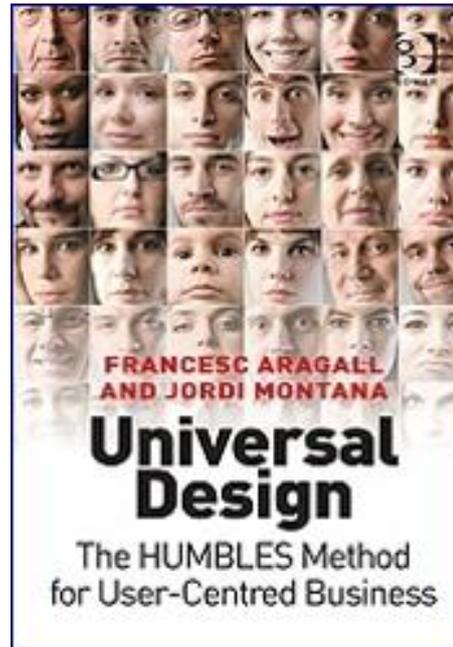


Practical Guide for Ecodesign – Including a
Toolbox

Author: Ursula Tischner



Universal Design: The HUMBLE Method for User-Centred Business



“Universal Design: The HUMBLE Method for User-Centred Business”, written by Francesc Aragall and Jordi Montaña and published by Gower, provides an innovative method to support businesses wishing to increase the number of satisfied users and clients

and enhance their reputation by adapting their products and services to the diversity of their actual and potential customers, taking into account their needs, wishes and expectations.

The HUMBLE method (© Aragall) consists of a progressive, seven-phase approach for implementing Design for All within a business. By incorporating the user’s point of view, it enables companies to evaluate their business strategies in order to improve provide an improved, more customer-oriented experience, and thereby gain a competitive advantage in the marketplace. As well as a comprehensive guide to the method, the book provides case studies of multinational business which have successfully incorporated Design for All into their working practices.

According to Sandro Rossell, President of FC Barcelona, who in company with other leading business professionals endorsed the publication, it is “required reading for those who wish to understand how universal design is the only way to connect a brand to the widest possible public, increasing client loyalty and enhancing company prestige”. To purchase the book, visit either the [Design for All Foundation website](#)

Appeal



News

1.

Course Design Considerations For Inclusion and Representation White Paper Released by Quality Matters

In thinking about equity and expanding opportunities for all learners, authors Racheal Brooks, PhD, and Siobahn Day Grady, PhD, address the concepts of diversity, equity and inclusion. Many learners are at a disadvantage when diversity, equity and inclusion are not properly considered in online course design. Instructors are encouraged to incorporate the elements described in the white paper, Course Design Considerations for Inclusion and Representation, released by Quality Matters.

The concepts of diversity, equity and inclusion are explained in the white paper in detail, and highlight the research that shows the importance of incorporating these three elements into online course design. The authors also explain the disadvantages many learners experience when the three elements are not present.

Several models for developing inclusive course design are described in the white paper, including Universal Design for Learning (UDL) – for ensuring access to learning for all; Inclusive Design Thinking, which centers the design process on learner

needs; and the Morrison, Ross and Kemp Instructional Design Model that includes nine core elements that are implemented cyclically.

The white paper also shares strategies for applying the psychosociocultural framework, which supports the redistribution of power in the learning space; validation theory; and engagement practices that emancipate learners from the systems and barriers that may hinder their success are shared.

The white paper offers several action items for course designers to address inclusion and representation and can be downloaded from the Quality Matters website.

About Quality Matters

Grounded in research. Driven by best practices. A community that puts learners first. Quality Matters (QM) is the global organization leading quality assurance in online and innovative digital teaching and learning environments. It provides a scalable quality assurance system for online and blended learning used within and across organizations. When you see QM Certification Marks on courses or programs, it means they have met QM Course Design Standards or QM Program Review Criteria in a rigorous review process.

The post **Course Design Considerations For Inclusion and Representation White Paper Released by Quality Matters** first appeared on PRUnderground.

(Courtesy: PRUnderground)

Programme and Events



berkeley prize

BERKELEY PRIZE 2022 LAUNCHES IN ONE MONTH

This year's topic:

DESIGN GUIDED BY CLIENTS' NEEDS:

Applying Social Factors Research to Architecture

A NEW QUESTION ON THE SOCIAL ART OF ARCHITECTURE AND A NEW
OPPORTUNITY TO CONSIDER THE WHY OF DESIGN

AS ALWAYS, THE POTENTIAL FOR UNDERGRADUATE STUDENTS TO WIN
CASH PRIZES IN THE ANNUAL ESSAY COMPETITION

AND, FOR THE SECOND YEAR, A CHANCE FOR PRIZE SEMIFINALISTS TO
RAISE MONEY AND RECEIVE A STIPEND TO PARTICIPATE IN A LOCAL
COMMUNITY SERVICE PROJECT RELATED TO THE TOPIC

IT ALL STARTS ON SEPTEMBER 15

TELL FRIENDS, STUDENTS AND FACULTY - FORWARD WIDELY

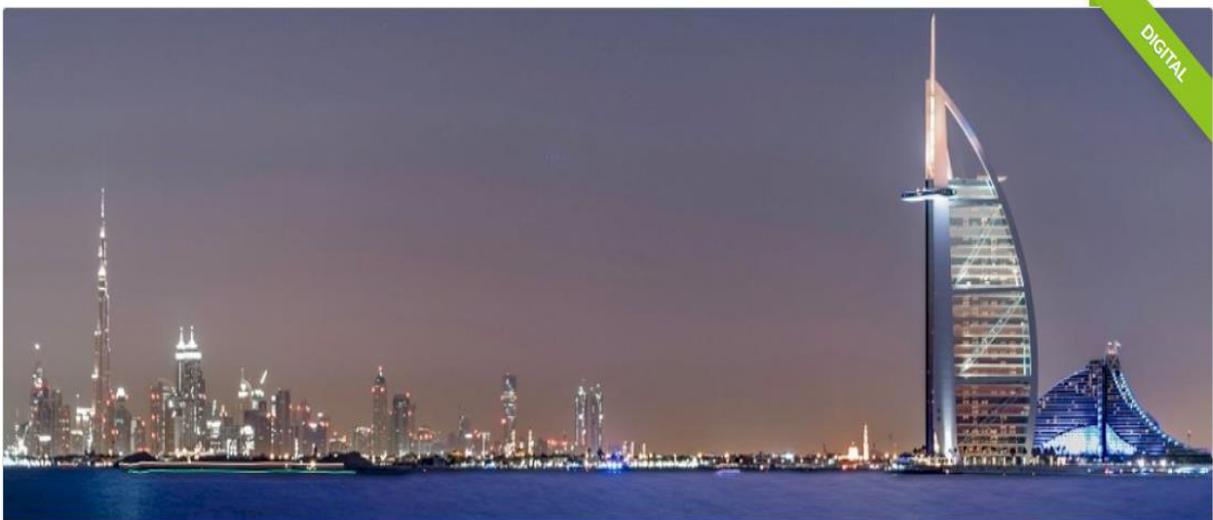
ICPDPD 2022: 16. International Conference on Product Development and Product Design

March 03-04, 2022 in Rio de Janeiro, Brazil



ICPID 2022: 16. International Conference on Product and Industrial Design

April 07-08, 2022 in Dubai, United Arab Emirates





UIA COMPETITIONS
18 JANUARY 2022



INTERNATIONAL ACCESSIBILITY SYMBOL DESIGN COMPETITION

The International Union of Architects (UIA) and Rehabilitation International (RI) are jointly inviting submissions for a **twenty-first century symbol of accessibility** to represent their core values of rights and inclusion, independence, physical and virtual accessibility for all, including people with disabilities.

The challenge is therefore to develop a new symbol of accessibility that better represents the variety of people who use buildings and other types of built environments. The competition invites **professional architects** and **graphic designers** as well as **architectural and graphic design students** to design a new graphic symbol of accessibility, to be proposed to the **International Organization for Standardization (ISO)** for adoption as the new international symbol of accessibility.



Rewarding Design
Excellence





2022 AUSTRALIAN GOOD DESIGN AWARDS - ENTRIES CLOSE 29 APRIL

The Australian Good Design Awards is open for entry across 11 Design Disciplines and covering more than 30 Categories. Get your entry in early to be a part of Australia's longest-running international design awards program.

 **ICCHP** Joint International Conference on Digital Inclusion, Assistive Technology & Accessibility - **AAATE** ICCHP-AAATE 2022, Lecco, Italy

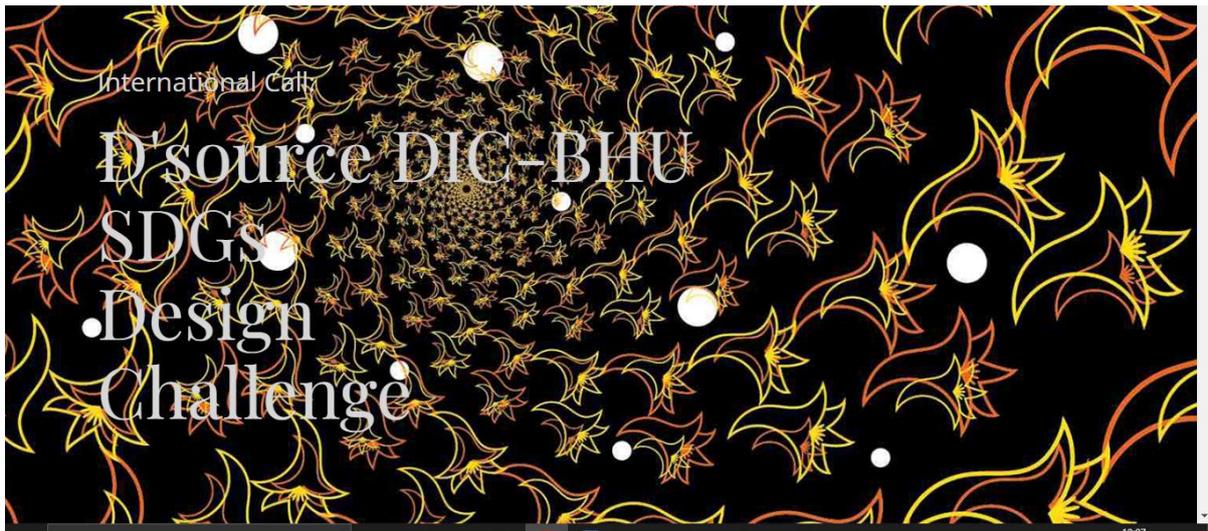


Welcome to ICCHP-AAATE 2022

In 2022, ICCHP and AAATE join forces and co-host the

Joint International Conference on
Digital Inclusion, Assistive Technology & Accessibility

taking place
July 11 - 15, 2022



Submission and Dates:

The first cut-off date for submission: 31st May, 2022

The first announcement of results: 30th June, 2022



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