Apprenticeship Inclusion Models (AIM)
For Youth And Adults With Disabilities

Using Universal Design for Learning in Apprenticeship

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About This Project

The U.S. Department of Labor's Office of Disability Employment Policy (ODEP) sponsored the Apprenticeship Inclusion Models (AIM) initiative. The initiative focused on building capacity for inclusive apprenticeship programs. It also focused on developing and disseminating resources and tools to make apprenticeship onboarding and recruitment, education and training, and workplace experiences and mentoring more inclusive, specifically for people with disabilities. In particular, the initiative sought to learn how inclusive practices from education, workplace, and work-based learning settings could be applied to apprenticeship and pre-apprenticeship programs. The AIM initiative used a universal accessibility lens in its work; thus, its activities were also designed to make apprenticeship programs more accessible for everyone. The initiative produced five briefs that provide information to support the scaling of inclusive apprenticeships and to inform and strengthen future national policy around inclusive apprenticeship, workforce development, and employment.

The AIM Policy and Practice Briefs

In support of AIM's objective to develop and disseminate resources and tools to make apprenticeship more inclusive of people with disabilities, the initiative has produced five briefs that provide information to support the scaling of inclusive apprenticeships and to inform and strengthen future national policy around inclusive apprenticeship, workforce development, and employment.

The entire series can be found at: https://www.dol.gov/agencies/odep

In This Series:

- Strengthening Supports for People With Disabilities in Pre-Apprenticeships Through Policy, Design, and Practice
- Funding Inclusive Apprenticeships: Strategies for Braiding, Blending, and Aligning Resources
- Using Universal Design for Learning in Apprenticeship
- Connecting Ticket to Work and Apprenticeships
- Emerging Lessons for Inclusive Apprenticeship Programs: Managing Through the COVID-19 Crisis and Beyond

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Brief Highlights

Apprenticeship programs operating in the United States provide skills training and career pathways to high-skill jobs for approximately half a million apprentices, and their expansion is a key priority of the federal government. Universal Design for Learning (UDL) offers a way for organizations to improve their programs and services while addressing accessibility concerns and increasing the pool of qualified candidates.

UDL is an evidence-based framework that educators use to systematically plan for and address learner differences through the design and implementation of inclusive training practices. UDL guidelines may be applied to the recruitment, assessment, workplace training, and related instruction efforts that make up apprenticeship programs, as well as to general approaches to offering supportive services. UDL offers the greatest impact when it is used during the program design stage as program designers consider how to:

- convey information that any learner can understand;
- effectively assess what a learner comprehends; and
- maximize a learner's motivation and perseverance.

This brief identifies a number of practices tested in education and work-based learning programs that would benefit apprenticeship and pre-apprenticeship programs.
These promising practices include:

- co-designing programs, tools, and materials alongside the learners and trainers who will use them;
- enabling learners to have autonomy by allowing them to make choices about how they learn as well as how they demonstrate understanding and skill acquisition;
- providing feedback that is specific, actionable, and focused on effort rather than on personal characteristics;
- securing public or private funding and stakeholder buy-in before systematic adoption of UDL practices;
- incorporating UDL practices into the instruction on UDL that is provided to teachers, apprenticeship trainers, mentors, and supervisors;
- applying classroom-tested UDL practices that translate to the apprenticeship setting, such as cooperative learning activities that minimize distractions and delivering information through multiple formats; and
- incorporating and/or developing tools and technologies that have been tested with individuals with diverse experiences, characteristics, and learning styles.

Introduction

Currently, there are nearly 25,000 Registered Apprenticeship programs (RAPs) operating in the United States.[1] These programs combine applied, on-the-job training with formal classroom instruction and provide skills training and career pathways to high-skill jobs for approximately 633,000 apprentices.[2] RAPs have been embraced by employers across a variety of high-demand sectors, including information technology, health care, logistics, manufacturing, and construction.

As illustrated in Exhibit 1, RAPs present an opportunity to fully integrate employers and their employees into the nation's education and training pipelines by engaging and supporting them, at their places of work, with employers as the primary trainers. By integrating learning into the workplace, RAPs enable the flexibility needed for workers to adapt to the increasing demands brought by technological change. Moreover, apprenticeships provide career pathway opportunities that are accessible to learners with varying educational levels. This increases the pool of available talent, which is a benefit for both employers and jobseekers. Over the last decade, RAPs have been championed by the public workforce, the education system, and employer partners as a sustainable strategy to address skill shortages and to develop pipelines of qualified talent and career ladders for employees.

Exhibit 1. Core Components of Registered Apprenticeship Programs

Adapted from the U.S. Department of Labor's *Building Registered Apprenticeship Programs: A Quick-Start Toolkit*

The AIM Initiative

Expanding apprenticeship opportunities is a key priority of the federal government—one that was reinforced by the 2017 Presidential Executive Order Expanding Apprenticeships in America.[3] The promise of apprenticeship is that it provides a structured pathway to skilled jobs that pay living wages for those who want to learn by doing. At a time of increasing wage inequality and a deep recession in the United States, it is more critical than ever for funders, policy makers, and RAP practitioners to consider how RAPs can be designed to be more inclusive of all job seekers.[4] Ensuring that there are multiple equitable on-ramps to apprenticeship opportunities is part of a current dialogue as we collectively consider how the good jobs of the future will be accessible to everyone, including people with disabilities.

[1] RAPs were established through the National Apprenticeship Act of 1937, which instituted standards that safeguard the welfare of apprentices. The scope and purpose of the system, as well as the standards, policies, and procedures for programs, are outlined in Title 29, Part 29, of the Code of Federal Regulations (29 C.F.R. § 29). Title 29, Part 30 of the Code asserts that RAPs are equal opportunities and that discrimination based on race, color, religion, national origin, sex, sexual orientation, age (40 or older), genetic information, or disability is prohibited.

[2] According to the U.S. Department of Labor (2019), there were 24,788 active programs and 633,476 apprentices between October 1, 2018, and September 30, 2019.

[3] While Executive Order No. 13801 references both RAPs and Industry Recognized Apprenticeships (IRAPs), this brief focuses on RAPs. See U.S. DOL (2012).

[4] Guidance on targeted recruitment is specified in 29 C.F.R. § 30.8. Suggestions include recruiting from organizations and PA programs that serve underrepresented groups.

In support of these expansion efforts, the Office of Disability Employment Policy (ODEP) at the U.S. Department of Labor (U.S. DOL) sponsored the Apprenticeship Inclusion Models (AIM) initiative. The AIM initiative focused on learning how apprenticeship and pre-apprenticeship programs can optimize learning for and inclusion of people with disabilities.[5] Specifically, the project sought to address the accessibility of apprenticeship and pre-apprenticeship programs' recruitment, assessment, mentoring, training, and instruction efforts, as well as their general approach to supportive services. In support of these objectives, the initiative has produced five briefs that provide information to support the scaling of inclusive apprenticeships. This brief considers the benefits of Universal Design for Learning (UDL) and focuses on how UDL can be incorporated into apprenticeship and pre-apprenticeship programs.

This Brief: Combining Registered Apprenticeship with UDL

RAPs offer a model for formative education that is both academic and hands-on. Compared with the traditional classroom learning model, this more flexible approach provides an appealing alternative for individuals with diverse learning styles, such as people with disabilities. Apprenticeship programs are structured so that information can be conveyed through a variety of settings: from the classroom to the workplace, through a teacher, a mentor, a co-worker, and even a fellow apprentice. With that noted, opening the door for diverse learners requires trainers to ensure apprentices can fully access and understand the information. UDL offers a way to unlock RAPs for all learners.

UDL is a framework for instructors and program designers to systematically plan for and address learner differences through the design and implementation of inclusive educational and training practices. Its widespread use stems from the premise that a traditional curriculum is difficult for some students to access because these students have learning preferences and needs that differ from those of traditional learners.[6]

In this brief, we set out to:

- explore how employers, mentors, and trainers operating RAPs are using UDL or similar practices;
- explore UDL's use in other work-based learning efforts beyond apprenticeship; and
- identify insights gained from non-apprenticeship programs that may translate to apprenticeship programs.

[5] The U.S. Department of Labor (2012) defines quality pre-apprenticeship programs in Training and Employment Notice No. 13–12. These programs blend classroom training with applied learning (e.g., work-based learning) and are designed to prepare individuals to enter and succeed in apprenticeships.

[6] See Meyer, Rose, and Gordon (2014).

Background: Development of UDL

UDL evolved out of the disability rights movement of the 1970s and the push to promote and secure inclusivity for people with disabilities in work, home, and social settings. The movement called for an extension of the anti-discrimination and social inclusion practices of the Civil Rights Act to individuals with disabilities.[7] With the signing of the Rehabilitation Act in 1973, designers in the architectural field began to consider how indoor and outdoor physical environments, as well as tools and products, should be redeveloped so that all individuals, including those with disabilities, could access them. The term Universal Design came to represent the design of products or environments that are accessible to all individuals, regardless of ability, age, or other potentially limiting factors.[8]

For students in educational settings, physical access marked a critical first step to inclusive learning experiences, but presence alone did not ensure equal access to the curriculum or benefits from the learning experiences. Drawing inspiration from physical and architectural concepts of UD, starting in the 1980s the Center for Applied Special Technology (CAST) began applying UD to other aspects present in learning environments and educational settings. It then went on to brand and define these newly articulated principles in the following decade. For educators, curriculum developers, researchers, and parents, UDL offers a framework for transmitting information and delivering instruction and assessments in a way that is more resonant with all learners—one that proactively accommodates differentiated styles of learning.

Key Principles of the UDL Framework

The UDL framework's central theme is the accommodation of varying learning styles by providing multiple options for representation, action and expression, and engagement:

Representation involves providing learners with multiple means of representing concepts, ideas, information, and other content throughout the learning process.

Action and expression pertains to providing learners with multiple means of communicating what they know, often through varying modalities.

Engagement refers to providing learners with multiple means of engaging with teaching content and providing opportunities to apply learned concepts to their own lived experiences.

UDL relies on activating different areas of the brain through multiple means of representation, action, and engagement so learners can (1) *access* the material, (2) *build* upon it, and (3) *internalize* the content.

[7] See U.S. Department of Justice (n.d.).

[8] See Centre for Excellence in Universal Design (n.d).

Applying UDL to Apprenticeship and Work-Based Learning/On-the-Job Training

RAPs are inherently structured so that apprentices have multiple ways to learn concepts they will apply in their careers. Learning happens through work, in real-world settings, and often alongside professionals practicing their trades. We recognize the compatibility of the structures of a RAP and the UDL framework, but we did not find examples of UDL explicitly being applied in a RAP.

We were, however, able to identify and interview eight respondents—subject matter experts and individuals representing pre-apprenticeship programs, career technical education (CTE), and employer training programs—who were actively working to incorporate components of the UDL framework into work-based training programs. These programs shared similar elements that could be translated to RAPs.[9] In addition to these interviews, we also reviewed literature and programming that considered the impact and use of UDL in both postsecondary classroom settings and other types of work-based learning programs. This brief elevates examples that offer parallels to current or future apprenticeship programming.

The body of research that examines the use of UDL in CTE programs is nascent but growing. The Strengthening Career and Technical Education for the 21st Century Act (also known as Perkins V), which was passed in 2018, recognizes UDL as a strategy that may help to improve and optimize teaching and learning for all people, including individuals with disabilities.[10] This addition of UDL in the law should give rise to a swell of new research, as well as examples of incorporating UDL into work-based learning programs.

State and National Efforts to Apply UDL in CTE

- College STAR (Supporting Transition Access and Retention) applies the UDL framework throughout several colleges in the University of North Carolina system.
- YouthBuild operates a Teacher Fellows initiative to train its educators in UDL practices.
- New Hampshire has instituted a statewide "Innovation Network" to train all teachers, including CTE teachers, in UDL practices.

For now, we identified recent efforts of individual institutions to integrate UDL into their educational practices, as well as three state- and national-level efforts to apply UDL to CTE. (The latter are described above, in the "State & National Efforts to Apply UDL in CTE" box.) These efforts demonstrate how instructors are using the framework to maximize inclusion of a diverse set of learners and promote the retention of students who, under other circumstances, might disengage.

A large and growing body of research supports the benefits of UDL in K–16 classrooms, and efforts such as the New Hampshire UDL Innovation Network are underway to integrate UDL into school districts across the country.[11] While it's not uncommon for RAPs to operate wholly outside traditional education communities, local education agencies (LEAs), such as school districts or community colleges, frequently serve in an advisory capacity to apprenticeship programs; LEAs assist with the development of training content as well as with testing and assessment elements. As apprenticeship programs seek to address inclusivity, we could see programs begin to adopt UDL practices organically, possibly starting with pre-apprenticeship programs or adoption during the recruitment and onboarding phase.

[9] The acknowledgments contains a list of organizations interviewed for this brief.

[10] See the brief entitled *Strengthening Supports for People with Disabilities in Pre-Apprenticeships Through Policy, Design, and Practice* (also in this series) for more details about Perkins V and its implications for RAPs and pre-apprenticeship. See also CAST (n.d.-a). UDL was first referenced and promoted in policy within the Higher Education Opportunity Act of 2008, and was subsequently defined and endorsed in the Every Student Succeeds Act (ESSA).

[11] See Boothe, Lohmann, Donnell, and Hall (2018); Crevecoeur, Sorenson, Mayorga, Gonzalez (2014); and Scott, Temple, and Marshall (2015).

Findings

According to the CTE and work-based learning practitioners we interviewed who were using UDL, the UDL framework offers the greatest impact when it is used during the program design stage, as program designers consider how to:

- convey information that any learner can understand;
- effectively assess what a learner comprehends; and
- maximize a learner's motivation and perseverance.

Used in this way, UDL carries benefits for program participants and administrators (as it could for both apprentices and apprenticeship program administrators). In particular, it offers alternative ways to perceive information, gather feedback, and optimize the delivery of training and self-directed choices of trainees.

Through our interviews, we learned about programs using UDL in the following ways:

Offering alternative ways to perceive information. Multiple respondents discussed the importance of providing information in a variety of formats so that training content could reach the greatest number of learners. For instance, when critical information is presented as text, trainers can have someone read the information aloud. (Ideally the reader understands the information and can provide appropriate verbal emphasis for the content.)

Providing "mastery-oriented" feedback. Two respondents discussed the importance of providing feedback that is actionable for the learner. UDL offers direction to provide feedback that guides learners toward mastery of a skill rather than fixed notions of performance or compliance. According to UDL principles, feedback should emphasize effort, improvement, and achievement of a standard rather than focus on relative performance. An instructor should be specific in both praise and critique. For example, rather than praising a student by stating, "good work," the instructor could say, "You tried multiple strategies to accomplish the task until you succeeded." Language that emphasizes work and practice, rather than fixed terminology like "intelligence" or inherent "ability," cues apprentices, especially those with disabilities, that achievement of a standard is attainable.

UDL supports all learners to become resourceful and knowledgeable.

Optimizing the relevance and delivery of training. Multiple respondents shared that one of the first ways programs could improve learner engagement and resist program attrition would be to vary the training approach and activities during the class-based portion. It is common for class-based instruction to be delivered in a lecture format. Even when the content is relevant to the learner, the static format and delivery of the curriculum will mean that some learners (such as those with processing delays or disabilities affecting attention and focus) will have difficulty concentrating; other learners (such as those with language-centered disabilities or hearing difficulties) will need to take additional steps, such as requesting and using accommodations just to access the information.

UDL supports all learners to become strategic and goal-directed.

Optimizing individual choice and autonomy. One respondent recommended that the most important UDL guideline program administrators could adopt would be to embed choice and autonomy wherever possible. Providing options to learners for how they demonstrate what they've learned (e.g., through testing, presentations, or physical demonstration) reinforces confidence in performing a task, supports positive interpretations of their own agency, and increases motivation and persistence when challenges arise.

Optimizing access to accessible tools and assistive technologies. Multiple respondents discussed how learners experience independence, participation, and progress when they can use the tools and materials provided to them. This means program designers should incorporate universally accessible tools and technology wherever possible and account for assistive technology where barriers persist. When a UDL-oriented curriculum is coupled with accessible technology, such as text-to-speech software, media-rich experiences, or flexible technology-based assessment systems, the approach affords greater support for both teaching and learning.[12] The STEMfolio (described later in the brief) is an early example of technology designed for universal accessibility in a learning environment.

Technology does not need to be designed from the ground up to be accessible in all circumstances, however. According to one respondent, smartphones and tablets are being used in workplaces for people on the autism spectrum and for people with intellectual disabilities to help provide structure to the workday. For example, in situations where an individual may have many daily tasks in a given workday, a digital scheduler can alert them when a particular task begins and include step-by-step guidance on how to complete it. For certain communities, including for people on the autism spectrum, this approach has been applied both in the execution of work tasks and for building rapport and communicating needs with peers through tools like social scripting.[13]

Accounting for learner perspective and context. An emerging tenet of UDL is that the design of lessons should consider the perspectives of the learners and the context in which they learn.[14] Several respondents emphasized the importance of incorporating a co-design process in the development phase—one in which instructors and learners develop training tools and content together. CAST is using a co-design process for the development of the IMTfolio in which designers are conducting trainings and focus groups to gather feedback and ensure the tool responds to needs of instructors and pre-apprentices who use it.

"You can't do [UDL] without co-design. How [else] would you know the right ways to support people and to demonstrate what they know? We have found that students want to show practices and use current media. And they want validation from respectful adults."—Researcher, CAST

[12] See Basham, Meyer, and Perry (2010); Dalton, Proctor, Uccelli, Mo, and Snow (2011); and Polirstok and Lee (2019).

[13] See Doyle (2017).

[14] See Indar (2018).

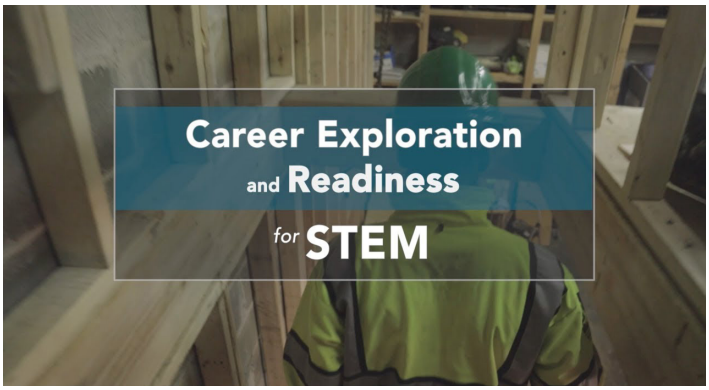
UDL Integration with Pre-Apprenticeship

Pre-apprenticeship administrators interviewed for this brief indicated that integration of UDL offered benefits for their programs, including improvements in test scores and increased self-confidence.[15] For example, a YouthBuild pre-apprenticeship program manager who had participated in the Teacher Fellows initiative described how he incorporated two specific UDL principles into his program:

Providing options for learners to perceive information by using a variety of formats for explaining concepts. He taught concepts through traditional lecture-based approaches as well as through small-group and peer-to-peer learning activities and hands-on demonstrations.

Providing options for learners to express and communicate what they knew and what they had absorbed through training units. For example, after completing a unit on how to balance chemical equations, he split the pre-apprentices into groups and tasked each person to teach the other members of their group how to balance an equation using a method that worked best for them personally.

CAST is working with YouthBuild to develop and incorporate a universally designed web-based career exploration and engagement tool—called the STEMfolio—to enhance the pre-apprenticeship experience of YouthBuild participants. Co-designed with the participants, the STEMfolio provides students a way to explore science, technology, engineering, and math (STEM) career pathways and demonstrate newly learned STEM competencies.



By using this e-portfolio tool, students can record and personalize the knowledge gains they make in the classroom, at the work site, and through community engagement. This can then be shared with instructors, potential employers, or even college admission staff. Importantly, as YouthBuild participants are primarily youth of color, the STEMfolio also includes profiles of people of color in STEM fields to demonstrate the viability of the career path.

[15] See the brief entitled *Strengthening Supports for People with Disabilities in Pre-Apprenticeships Through Policy, Design, and Practice* (also in this series), for more details about UDL's relationship to pre-apprenticeship.

The Potential of UDL for Apprenticeship

For respondents just becoming familiar with UDL, initial updates have tended to be simple in-class adjustments that do not require changes to approved curricula or coordinated activities with partners and fellow instructors. For instance, to reduce late or missing assignments, one instructor described using different-colored shapes as markers on the classroom schedule as a mechanism for increasing students' awareness of critical assignment due dates. Another respondent described a CTE instructor who, after participating in a UDL training, changed his teaching approach from lecture-based delivery with a slide deck for support to a set of hands-on activities for students. Another respondent was a corporate disability consultant who noted that, while companies often pour resources into developing training manuals, the delivery of that training is typically through a lecture-based approach only. To address this, the first adjustments he recommended are for trainers to decrease the number of words they speak and increase the number of visual supports and modeling they provide.

"Apprenticeships are collaborative, and UDL reinforces that. UDL helps the apprentice demonstrate what they're learning and the employer create ways for them to convey what they want to teach. Employers want the apprentices to be successful, and UDL helps employers to make valuable adjustments."
—Researcher, CAST

Small adjustments to training approaches will often unlock additional downstream benefits. For example, one respondent offered an example of a safety training course that delivered instructions using visual images. For the benefit of blind learners or those with low vision, the trainer developed text that corresponded with the images. The trainer then discovered that by doing so, English-language learners could take the text, input it into an online language translator, and have native language access to information about an image they did not understand very well. In another example, a respondent discussed how adding closed captioning to training videos not only benefited learners with hearing impairments but also helped students who needed to study while in noisy public settings.

"We're finding that UDL does not eliminate the need for accommodations, but it may reduce their need and improve their effectiveness."—Researcher, CAST

As UDL becomes more ingrained in the design and delivery of training, research suggests that it will improve the performance of students with learning disabilities, reduce their need for supports or accommodations, and increase their self-confidence.[16] In a survey of nearly 300 high school students, approximately 13% of whom had a disability, more than 90% of students reported positive experiences with UDL in the classroom, and they called for their teachers to use UDL more often.[17] Similarly, our interview respondents reported consistent positive effects for their students. For example, one respondent stated that after bringing UDL into his teaching approach, students became "comfortable in the classroom and open to learning….I think what [UDL] does is it gives [students] the feeling of empowerment."

[16] See Hall, Cohen, Vue, and Ganley (2015); He (2014); and Kumar and Wideman (2014).

[17] See Kortering, McClannon, and Braziel (2008).

This sentiment was echoed by a UDL trainer with CAST, who noted that addressing motivation through choice and autonomy has been shown to improve completion rates in education and offer a way for apprenticeship programs to respond to challenges with retention and graduation. Importantly, the UDL trainer discussed concerns that apprenticeship program administrators have shared with CAST—that some apprenticeship programs are graduating just about 50% of their apprentices. This turnover has real economic costs to the program and to employers. Increasing motivation through choice and autonomy, in keeping with UDL guidelines, presents an evidence-based approach to addressing that challenge.

UDL supports all learners to become purposeful and motivated.

Challenges Adopting UDL

Although schools have widely implemented UDL in traditional education settings, the framework remains still largely unknown in work-based learning settings and the larger workforce development system. As apprenticeship programs aim to incorporate UDL practices, they'll need to consider the following approaches:

Seeking buy-in from instructors, administrators, or partners. Several respondents noted hurdles to implementing UDL practices because key personnel administering the apprenticeship pipeline, such as instructors or program administrators, were "uninterested" or otherwise resistant to new approaches to teaching.

Securing resources to upskill instructional staff and update program elements.[18] The majority of respondents we spoke with had been exposed to UDL training because of independent federal or private grant funding. We spoke with one pre-apprenticeship program administrator who was interested in incorporating UDL into the program but did not have the financial resources to support teacher training or the time available to provide professional development to instructors to update their curricula and practices. Similarly, the administrator reported that partnering apprenticeship program instructors faced the same limitations.

[18] While Perkins professional development funds were not cited by respondents, the brief entitled *Strengthening Supports for People with Disabilities in Pre-Apprenticeships Through Policy, Design, and Practice* brief (also in this series) discusses the availability of these funds. Additionally, Pre-Employment Transition Services funding (available through state Vocational Rehabilitation agencies) may enable training on UDL under "authorized" activities if funds remain after delivery of "required" activities.

Conclusion

UDL was developed as a framework to include learners with differentiated learning styles in education and training. While the guidelines evolved out of disability rights initiatives, UDL shows benefits for all learners. Work-based learning and CTE programs are using UDL to promote inclusivity, address equal employment opportunity regulations, document learner skill gains, accurately assess program effectiveness, and address low retention and graduation rates. We identified several promising practices that can benefit all apprentices as well as apprenticeship and pre-apprenticeship program administrators, employers, educators, and other stakeholders:

Design apprenticeship courses, materials, and other program elements with learners included in the process. The UDL framework can be applied by an instructor's own initiative to improve accessibility. However, a well-designed course transpires through a collaborative approach with students, so that the multiple means of representation, expression, and engagement are accurately contextualized for participating students. UDL has the greatest impact when it is used during the program design stage. When teaching, instructors often naturally contextualize and use UDL approaches, but they may not be aware of the research and may not systematize their practice.

Help students increase self-confidence by optimizing individual choice and autonomy. Programs can optimize choice in myriad ways, such as through the type of rewards or recognition available, the context or content used for practicing skills, the sequence or timing for completion of tasks or activities, and so on. Research suggests the UDL approach helps students reject negative self-perceptions.[19]

Provide "mastery-oriented" feedback to help learners focus on skill-building. Instead of more generalized and non-descript feedback, instructors can provide apprentices with both praise and constructive critique that guides them toward mastery of a skill. This happens by communicating specific detail about what the learner did and how it either yielded success or presented an important lesson. This will cue apprentices, especially people with disabilities, that achievement is attainable.

Identify and secure both financial resources and instructor buy-in before systematic adoption of UDL practices. Respondents with whom we spoke had experienced UDL training because of independent federal or private grant funding, or they were seeking such funding. At least two funding sources—Perkins professional development funds and Pre-Employment Transition Services funding available through state Vocational Rehabilitation agencies—could potentially support staff training on UDL. Additionally, the systematic adoption of UDL principles is perceived to be more effective than a single champion getting trained and sharing practices with peers.

Ensure that UDL training for instructors incorporates UDL practices. Trainers in the apprenticeship and workforce development systems often have expertise and educational backgrounds that differ from K–12 educators, which may include limited exposure to UDL concepts. Respondents recommended that to have lasting impact, apprenticeship instructors and program partners need to buy-in to UDL, and that buy-in can best be achieved by using a UDL approach when teaching UDL concepts.

[19] See CAST (n.d.-b).

Make small-scale changes that use UDL, even when systematic adoption is not feasible. UDL as a model of designing for everyone produces downstream benefits, in which changes designed to support one type of learner typically benefit others. Examples of small-scale changes we identified included increasing visuals and modeling during training, pairing text with visual descriptions, and adding captions to videos.

Integrate UDL practices that have demonstrated success at the college and university level. This could include incorporating small-group cooperative learning activities, highlighting key information using explicit language and modeling, and minimizing distractions (e.g., ensuring that technologies used in the program are straightforward to navigate, which can help apprentices pay attention to the content). It can also mean offering materials in multiple formats.

Couple UDL-oriented curriculum with accessible and assistive technologies. Pre-apprenticeship programs and other work-based learning efforts are incorporating built-in technologies like text-to-speech software, multimedia experiences, and technology-based tools and adjusting their training approaches correspondingly. Customized tools like the STEMfolio and IMTfolio incorporate universal design features within the tool itself. When products and processes incorporate Universal Design practices, the need for accommodations—especially technology-related accommodations—is reduced.

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Appendix A

UDL GUIDELINES

1. ENGAGEMENT
providing learners with multiple means of representing concepts, ideas, information, and other content throughout the learning process.

Affective Networks
The ***WHY*** of Learning

a. ***Access*** **happens by providing options designed to recruit interest**, such as by providing opportunities for making choices and offering autonomy.

b. ***Building*** **happens by sustaining effort and persistence** through, for example, provision of "mastery-oriented" feedback to learners.

c. ***Internalization*** **happens by providing options for self-regulation** through, for example, self-assessment and reflection.

GOAL: Expert learners who are...
Purposeful and Motivated

2. REPRESENTATION
providing learners with multiple means of communicating what they know, often through varying modalities.

Recognition Networks
The ***WHAT*** of Learning

a. ***Access*** **happens by providing options for perception**, such as visual or auditory.

b. ***Building*** **happens by providing options for language**, such as multimedia formats.

c. ***Internalization*** **happens by providing options for comprehension** (e.g., by highlighting patterns and big ideas).

GOAL: Expert learners who are...
Resourceful and Knowledgeable

3. ACTION AND EXPRESSION
providing learners with multiple means of engaging with teaching content and providing opportunities to apply learned concepts to their own lived experiences.

Strategic Networks
The ***HOW*** of Learning

a. ***Access*** **happens by providing options for physical action** (e.g., by using tools and assistive technologies).

b. ***Building*** **happens by providing options for expression and communication** (e.g., by using multiple forms of media for presentation).

c. ***Internalization*** **happens by providing options for executive functions**, such as goal setting.

GOAL: Expert learners who are...
Strategic and Goal-Directed