

Universal Design for Learning in Tertiary Education

A Scoping Review and Recommendations for Implementation in Australia

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Executive Summary



Universal Design for Learning is defined as a framework to improve and optimise teaching and learning for all people based on scientific insights into how humans learn (CAST, 2021). Learner diversity can comprise physical, visual, hearing, sensory, attention, and communication barriers. UDL recognises there is no ‘average’ learner and that learners come with a wide variety of prior experiences, abilities, preferences and needs, and enables curricula to be written flexibly so they are accessible to the highest number of learners, addressing the variance in the student population. At the same time, UDL does not negate the need to make extra accommodations for some learners. This project fills a gap in the Australian literature by drawing together literature and practice on UDL in the tertiary level in Australia, uniquely it treats post-school education as a single system and presents findings that are in the most part applicable in both VET and higher education.

This report completes a systematic comparison of the Australian and international applications of UDL demonstrates a lack of evidence available on the use of UDL in tertiary level education in Australia. From a human rights perspective, diversity should not deprive people from equal opportunities in education. However, initial scoping has identified that UDL principles are not yet fully or consistently embedded in the development of tertiary education coursework or curriculum in Australia.

In Australia, UDL appears in only a small number of policies and tertiary institute websites, likely attributed to lack of reinforcement in Government policies in higher education and VET, and subsequent slow adaptation of UDL in these sectors. In the past decade, examples of the UDL approach in higher education have been published, though only a few examples of applying UDL at an institute level are available in the literature.

Those who implemented UDL into their academic courses identified barriers, such as the time required to prepare, the expense of technology as well as the physical environment of the classroom.

The comprehensive search catalogued international examples where UDL is applied in teaching curriculum indicate that effectiveness occurs when there is a whole of faculty or institute approach, and where faculty members are educated in its application. As such, the training of faculty staff was identified as a requirement for successful UDL implementation. Limiting factors in the application of the UDL approach at the tertiary level need to be considered and addressed in order to ensure the effectiveness of its application.

UDL is a framework that enables curricula to be written flexibly so they are accessible to the highest number of learners, addressing the variance in the student population. At the same time, UDL does not negate the need to make extra accommodations for some learners. In the past decade, examples of the UDL approach in higher education have been published. However, only a few examples of applying UDL at an institute level are available in the literature. Those who implemented UDL into their academic courses identified barriers, such as the time required to prepare, the expense of technology as well as the physical environment of the classroom. Furthermore, training of faculty staff was identified as a requirement for successful UDL implementation. In Australia, UDL appears in a small number of policies and tertiary institute websites. Perhaps it is the limited reference to UDL, and lack of reinforcement in Government policies in higher education and VET is partly associated with the slow adaptation of UDL in these sectors.

Recommendations

An increase in the application of the UDL framework and principles in tertiary educator practice is likely to generate evidence to inform a shift in tertiary education policy towards inclusive design that will better meet the needs of diverse learners. Based on our review of the literature we have identified the following practice and policy-based recommendations:

1. Training in UDL should be a requirement for all staff involved in course design and student facing engagement in the tertiary education sector. This type of training should be based upon and model the principles of UDL and be tailored to the needs of the tertiary education sector to proactively meet the needs of diverse learners
2. Tertiary education institutes should publicly commit, through organisational strategy and policies, to provide educators and learning designers UDL training programs and activities to increase institutional capability

3. Tertiary education institutes should, through organisational strategy and policies, adequately resource application of UDL in curriculum design and delivery, and support UDL application through procurement practices which ensure learning technologies are accessible
4. Through a coordinated approach of working parties, consortiums, and/or communities of practice, tertiary educators and learning designers could strategically share and document learnings for continuous improvement in effective implementation of UDL
5. In conjunction with the Recommendation #4, researchers could capture and publish new findings related to the implementation of UDL in the Australian tertiary education sector, to build the local evidence-base and inform a shift in Australian Government tertiary education policy towards inclusive design that will better meet the needs of diverse learners
6. Tertiary education institutions, as part of strategic planning and student support frameworks, could look for ways to garner support for UDL by articulating how UDL might proactively meet the needs of a larger number of students, thus reducing the need for students to seek additional support to successfully complete their studies (and thus reducing workload for educators and administrators). This may allow more targeted and intensive resources to be prioritised for those with more complex needs
7. In conjunction with Recommendation #6, tertiary education institutions could look for ways to measure the impact of the introduction of UDL into course design and delivery (for example, through user testing, surveys, and focus groups with students) and how UDL might maximise equitable access to tertiary education for all learners (for example, by reducing the onus on individual students to share information about their personal circumstances and reducing the number of requests for individual accommodations)
8. The proposed [Student Equity in Higher Education Roadmap](#) could include a national tertiary education strategy for people with disability aligned to the recommendations of the 2020 Review of the Disability Standards for Education Final Report
9. Aligned with the Australian Government widening participation priority, Australian Government Agencies could articulate their broad support for the application of UDL principles in the design and delivery of tertiary education coursework, through position statements, funding for initiatives to increase knowledge and skill in UDL, and the development of policy that includes reference to the implementation of UDL.

Introduction



Universal Design for Learning (UDL) is defined as a framework to improve and optimise teaching and learning for all people based on scientific insights into how humans learn (CAST, 2021). Learner diversity can comprise physical, visual, hearing, sensory, attention, and communication barriers. UDL recognises there is no ‘average’ learner and that learners come with a wide variety of prior experiences, abilities, preferences and needs, and enables curricula to be written flexibly so they are accessible to the highest number of learners, addressing the variance in the student population. At the same time, UDL does not negate the need to make extra accommodations for some learners.

From a human rights perspective, diversity should not deprive people from equal opportunities in education. However, a comparison of Australian and international applications of UDL demonstrates that there is a lack of evidence available on the use of UDL in tertiary level education in Australia.

Initial scoping of the literature and the policies and resources of Australian tertiary education institutions has identified that UDL principles are not yet fully or consistently embedded in the development of tertiary education coursework or curriculum in Australia.

In Australia, UDL appears in only a small number of policies and tertiary institute websites, likely attributed to lack of reinforcement in Government policies in higher education and VET, and subsequent slow adaptation of UDL in these sectors. In the past decade, examples of the UDL approach in higher education have been published, though only a few examples of applying UDL at an institute level are available in the literature. Those who implemented UDL into their academic courses identified barriers, such as the time required to prepare, the expense of technology as well as the physical environment of the classroom.

Limiting factors in the application of the UDL approach at the tertiary level need to be considered and addressed to ensure the effectiveness of its application. However, it is also important to consider the factors that might enable the successful use of UDL in tertiary education.

International examples where UDL is applied in teaching curriculum indicate that effectiveness occurs when there is a whole of faculty or institute approach, and where faculty members are educated in its application.

As such, the training of faculty staff was identified as a requirement for successful UDL implementation.

Purpose

Introducing the UDL framework to tertiary educators presents an opportunity to guide educators in designing and delivering more accessible and systematic courses. An increase in the application of the UDL framework and principles in tertiary educator practice is likely to generate evidence to inform a shift in tertiary education policy towards inclusive design that will better meet the needs of diverse learners. The purpose of this scoping review is threefold.

- The first purpose was to identify current definitions and principles of UDL.
- The second purpose was to identify and describe the ways in which the principles of UDL are used in tertiary education, drawing on international research and case examples.
- The third purpose was to identify the ways in which UDL is enacted in the tertiary education sectors in Australia, drawing on publicly available policies and online resources from Australian tertiary education institutions.

This Literature Review and Environmental Scan has been used by the Australian Disability Clearinghouse on Education and Training (ADCET) and the National Disability Coordination Officer (NDCO) Program to inform the development of Australia's first free online UDL training for tertiary educators.

Search Strategy

Three relevant databases were searched for this project: ERIC, Web of Science and Scopus using the terms “Universal Design for Learning”, “Tertiary Or University Or post-secondary”, and “curriculum”. The search only included articles between 2010 and 2021 that are full text and in English. The searches resulted in 37 papers from ERIC, 25 papers from Scopus and 18 papers through the Web of Science. The search included Australian and international academic papers.

After removing the duplicates (9) and those that did not meet the selection criteria (28), 43 academic articles were screened and 27 were excluded at full-text review level by the author. As a result of the full text review 16 academic articles were included in this literature review. Furthermore, 9 papers that were found during the full-text review to meet the selection criteria were also included. Additionally, an exception was made to include articles that were published before 2010, books and relevant websites (i.e. CAST) to reference definitions and original concepts.



Universal Design for Learning: Literature Review



Concepts and Origins

Universal Design for Learning (UDL) is an educational framework that is derived from the Universal Design (UD) concept of physical environments (Mcguire, Scott, & Shaw, 2006), where the physical structures are built to be accessible to a wide range of users (Story, 2001).

The difference is that UDL is applied in the educational environment to ensure that a maximum number of learners are engaged regardless of their age, cognition, physical ability, cultural background and learning style (Pisha & Coyne, 2001).

UDL was proposed at the Centre of Applied Special Technology (CAST), Massachusetts, US, as a form of educational neuroscience (Rose & Meyer, 2002). Educational neuroscience is an emerging field of research that studies the applications of neuroscience concepts in the context of Education (Blakemore & Frith, 2005). Furthermore, lifelong learning has been recognised to be highly impacted by the memories and the emotional engagement of the learner (Immordino-Yang, 2015).

Therefore, from the point of view of neuroscience, UDL means to apply the recognition network (the experience of the learning), the strategic network (demonstration of knowledge) and the effective network (the motivation and emotional involvement) of the brain to generate an optimal learning experience (Novak & Thibodeau, 2016).

Furthermore, UDL considers that learning is influenced by multiple intertwining factors such as the course design, the environment where the learning occurs, and the student’s motivation to learn. Therefore, the UDL framework provides flexibility in the presentation of educational material, the methods of learner’s engagement and their demonstration of knowledge (Glass, Meyer, & Rose, 2013).

UDL was first proposed as a pedagogical framework for school students k-12, then later adopted by college and university instructors (Burgstahler & Cory, 2010) based on the idea that diversity in the classroom is predictable and can be addressed by providing a flexible curriculum (Glass et al., 2013). As an example, one variance in classroom population is students from a non-English speaking background. Applying UDL to a curriculum means that these students are already accommodated (Glass et al., 2013).

Definitions and Principles

Universal Design for Learning (UDL) is defined as an adaptable framework that can be applied to all levels of education to design educational instructions (Wu, 2010). It is an approach for enabling the curriculum to eliminate barriers to learning (Dinmore & Stokes, 2015). UDL is also defined as an “inclusive pedagogical approach that can be applied to any educational context regardless of discipline, student age, demographic or skill level” (Balta, Supple, & O’Keeffe, 2021, p. 72). Despite the differences in how scholars worded their definition of UDL, there appears to be a consensus on the general understanding of UDL in a tertiary setting; UDL is a flexible educational framework that aims at making the educational material accessible to the largest number of students. All the reports reviewed for this literature review adhered to the three principles of UDL:

- Provide multiple means of engagement
- Provide multiple means of representation
- Provide multiple means of action and expression

Universal Design for Learning Guidelines

	Provide multiple means of Engagement Affective Networks The “WHY” of learning 	Provide multiple means of Representation Recognition Networks The “WHAT” of learning 	Provide multiple means of Action & Expression Strategic Networks The “HOW” of learning 
Access	<p>Provide options for Recruiting Interest</p> <p>Optimise individual choice and autonomy</p> <ul style="list-style-type: none"> • Optimise relevance, value, and authenticity • Minimise threats and distractions 	<p>Provide options for Perception</p> <ul style="list-style-type: none"> • Offer ways of customising the display of information • Offer alternatives for auditory information • Offer alternatives for visual information 	<p>Provide options for Physical Action</p> <ul style="list-style-type: none"> • Vary the methods for response and navigation • Optimise access to tools and assistive technologies
Build	<p>Provide options for Sustaining Effort & Persistence</p> <ul style="list-style-type: none"> • Heighten salience of goals and objectives • Vary demands and resources to optimise challenge • Foster collaboration and community • Increase mastery-oriented feedback 	<p>Provide options for Language & Symbols</p> <ul style="list-style-type: none"> • Clarify vocabulary and symbols • Clarify syntax and structure • Support decoding of text, mathematical notation, and symbols • Promote understanding across languages • Illustrate through multiple media 	<p>Provide options for Expression & Communication</p> <ul style="list-style-type: none"> • Use multiple media for communication • Use multiple tools for construction and composition • Build fluencies with graduated levels of support for practice and performance
Internalise	<p>Provide options for Self Regulation</p> <ul style="list-style-type: none"> • Promote expectations and beliefs that optimise motivation • Facilitate personal coping skills and strategies • Develop self-assessment and reflection 	<p>Provide options for Comprehension</p> <ul style="list-style-type: none"> • Activate or supply background knowledge • Highlight patterns, critical features, big ideas, and relationships • Guide information processing and visualisation • Maximise transfer and generalisation 	<p>Provide options for Executive Functions</p> <ul style="list-style-type: none"> • Guide appropriate goal-setting • Support planning and strategy development • Facilitate managing information and resources • Enhance capacity for monitoring progress
	Expert Learners who are...		
Goal	Purposeful & Motivated	Resourceful & Knowledgeable	Strategic & Goal-Directed

Figure 1 UDL Guidelines (CAST, 2018)

These three principles of UDL were evident in all identified examples of how authors applied the UDL approach to their courses, with the exception of one report (Ashman, 2010). Ashman followed the seven principles of Universal Design (UD) that are used to guide the development of another inclusive educational framework, Universal Design of Instructions (UDI; McGuire et al., 2006). These seven principles, proposed in 1997 by The Centre of Universal Design (Centre for Universal Design, 1997), are:

- equitable use,
- flexible use,
- simple and intuitive application,
- perceptible information,
- tolerance for error,
- low physical effort, and
- accessible size and space

A further two principles (McGuire et al., 2006) were later added;

- the establishment of a community of learners, and
- a positive instructional climate (Centre for Universal Design, 1997)

UDL implementation in the curriculum means shifting the teaching paradigm from an instructor-centred to a student-centred approach with a clear presentation of the instructor's expectations (Gravel, 2018). Despite the various definitions of UDL that appear in the literature, the general understanding of UDL remains consistent as a curriculum with an emphasis on flexibility, which provides educators with a framework that allows for multiple means of learner's Representation, Engagement and Expression (CAST, 2018).

Implementing UDL in an educational context requires the application of its three principles to curriculum design; Representation, Engagement and Expression (CAST, 2018; Rose, 2005). These three principles correspond to the brain pathways required for learning (Rose, 2005).

Table 1. The relationship between UDL and educational neuroscience (Rose & Strangman, 2007)

UDL Principle	Corresponding Brain Networks
<p>Multiple Means of Representation</p> <p>To provide learners with various ways of experiencing the information by engaging multiple sensory systems (videos, pictures, graphics and tactile resources).</p>	<p>The recognition networks</p> <p>These networks are responsible for recognising and identifying the information (perception). They are responsible for the ‘what’ in the learning.</p>
<p>Multiple Means of Engagement</p> <p>To tap into learner’s motivation, self-reflection interests and individual experiences (by allowing open discussions, interactive periods, and goals setting).</p>	<p>The effective networks</p> <p>The effective networks are situated in the emotion-processing part of the brain, where the significance of the acquired information is decided. The networks are responsible for the ‘why’ in learning.</p>
<p>Multiple Means of Expression</p> <p>To provide learners with various ways of demonstrating their knowledge (such as by creating portfolios and multimedia assignments and presentation).</p>	<p>The strategic networks</p> <p>These networks are responsible for the ‘how’ in acquiring knowledge. They are situated in the parts of the brain responsible for planning, organising, and execution.</p>

Strategies and Living Examples in Tertiary Education

Several recent published examples of UDL in post-secondary and tertiary education settings (both at a course and an institute level) were identified in the current review, including published protocols of UDL applications to scientific, language, education and online classroom settings (n=5).

Examples of Using Technology and Online Tools to Apply UDL Principles

In the past decade, evidence has emerged supporting the effectiveness of applying UDL approaches in tertiary education. Technology and online resources have been used to deliver flexible learning material in different parts of the world. Several identified published reports describe the use of technology and online tools to apply UDL principles.

In the teaching discipline, WebQuest was successfully used to prepare Allied Teachers in Singapore to use UDL in their teaching (Yang, Tzuo, & Komara, 2011). WebQuest was chosen as a tool to apply UDL principles because it allows for inquiry-based learning in authentic tasks using pre-defined internet sources or printing material (Dodge, 2001). With WebQuest, students use a problem-solving approach to engage in the task within pre-defined parameters by the instructor (Dodge, 2001). Students can use pre-design and pre-defined internet resources. WebQuest enables students to focus on gathering, analysing and evaluating the information to complete the clearly defined task by their instructor (Dodge, 2001). Using surveys as a data collection tool, Yang et al. (2011) found that students felt that using the WebQuest tool enhanced their problem-solving skills and encouraged them to use creative thinking (Yang et al., 2011). Further, students also commented that WebQuest improved their understanding of using technology in their classes (Yang et al., 2011).

Augmented Reality (AR) was another technology that was used to apply the principles of UDL to college-level course content (McMahon, Cihak, Wright, & Bell, 2016). McMahon et al. (2016) used a mobile phone/iPad application (Aurasma) to blend digital learning with the physical environment. Although the use of this technology had a positive impact on learners' engagement with the content of the material, it was only used with students who had a diagnosis of Autism and Intellectual Disability.

Tobin (2014), suggested five strategies to help to incorporate the UDL approach into an online course to increase student retention (Tobin, 2014);

Start by text. The authors indicate that this step helps instructors to identify gaps in their information.

Create alternatives such as a video and a text of the same material.

Let them do it their way. Here, the authors suggest allowing students to choose their preferred methods and to specify clearly when this is not allowed.

Go step by step by breaking processing into multiple smaller steps. By doing this, students can consume smaller parts as many times as they need, instructors can modify certain parts more easily and quickly.

Set content free by using readily available tools such as lecture recording on YouTube links.

Tobin (2014) claimed that these strategies address time constraints as they require less than an hour to apply. However, with the increase of internet utilisation and the fast advances in technologies in 2021, Tobin's strategies would require closer examination to determine their current viability.

Ten specific strategies were proposed by Coy (2016) to apply the UDL approach to the post-secondary curriculum at university level for online, blended as well as face-to-face courses (Coy, 2016);

Identifying barriers. Teachers are encouraged to create an inventory of all possible barriers in the learning environment. This then will enable them to think about how to address each barrier.

Provide options for recruiting interest. This point encourages the teachers to connect the assessment to the learning objective of the course, which would give relevance and value to each assignment or assessment.

Provide options for sustaining effort and persistence. In this strategy, the authors remind instructors to provide multiple places and points for students to get help.

Provide options for self-regulation, for example, by using Surveys at the midterm point of students' understanding of the course objectives and making the data available so students can check their own level of progress in understanding the course material.

Provide options for physical action. This point addresses the physical component of the digital environment; the devices used. Instructors are reminded of the need to ensure students know how to use these devices by providing the necessary education to eliminate barriers that could be created by the physical part of the digital learning classroom. In the face-to-face classroom, options such as working in small groups, using messages, Facebook chat and creating iMovies provide learners with multiple options of physical action.

Provide options for expression and communication. The author encouraged instructors not to assume that all students know how to use the freely available various means of expressions such as creating video and presentations. Also, they emphasised that one means of expression might not be suited to every student in the classroom, and therefore, it is important to identify multiple means or ways students can communicate their knowledge and present their assignments.

Provide options for executive functions. Instructors are encouraged to provide the students with the story and the reasoning behind their choice of material when developing the course. Also, to provide options for multiple means of representation rather than a completely open choice where it could be overwhelming to students.

Provide options for perception; the author used the On-Campus website by CAST as an example of how syllabus can be provided digitally to all students so a screen reader can be utilised.

Provide options for language, mathematical expressions, and symbols by providing information to all students on the accessibility options for web platforms.

Provide options for comprehension: Zoom and Google hangouts

The author provided practical examples on how to achieve each of the strategies in the physical as well as the digital classroom. In addition to the strategies above, Coy (2016) provided instructors with actionable objectives using the three UDL principles and nine checkpoints.

Two other detailed reports of how to apply UDL principles to online course design were published in 2018 (Gronseth, 2018; Houston, 2018). In Houston (2018), a detailed protocol of how to apply the UDL framework into phases of online course design was employed. They further provide examples and alternative strategies, focusing on enabling educators to address the diversity in their online classrooms (Houston, 2018). At the same time, Gronseth (2018) focused on the blending of Web Design Accessibility Guidelines (Caldwell et al., 2008) and UDL principles to meet the needs of all learners, including marginalised groups.

Examples of Applying UDL Principles into Course Curricula

Multiple examples were identified of the successful integration of UDL principles into college and university curricula.

A teaching reflection paper by Ashman (2010) described the application of UDL into two postgraduate educational courses delivered remotely for the duration of one semester. The principles applied in this example are the nine proposed by the Centre of Universal Design in 1997, rather than the three Principles of UDL currently adopted by CAST. Ashman described how dialogue was undertaken with students, drawing on personal experiences in an external course and the isolation students might experience undertaking asynchronous online courses. Students were encouraged to communicate via emails and on the Blackboard site with the author as well as each other. This created interaction amongst the group as well as a sense of being able to express their interest, opinions and concerns. In terms of the learning material, the author included introductions to topics, a collection of papers with practical components, book chapters and learning guides. Each topic had an introduction and material to support learning. Assessments were flexible, where students were given the choice of topic and mode of their assignment. The outcome of this experiment was mostly positive, as indicated by the students' emails to the author expressing their satisfaction with course delivery and specifically with the regular and prompt interaction and support provided by the author.

At the College of Natural Sciences, Colorado State University, Colorado, US, four instructors in the Introduction to Psychology were trained on UDL (Schelly, Davies, & Spooner, 2011). The researchers in this study used pre- and post-intervention surveys of students' perception of the instructors use of UDL. The students of this unit reported that they perceived that their instructors used more UDL in how they presented material and engaged with their students (Schelly et al., 2011). In a follow-up study, the students reported that they had a better understanding of the material presented to them when the UDL approach was used by the instructors (Davies, Schelly, & Spooner, 2013).

In a study of the use of reflective practice with a research methods course instructor (in the south-east of US), the three UDL principles were applied to the design and the delivery of the course, focusing on the neural learning pathways of the brain (Smith, 2012). To engage the recognition network (multiple means of representation), the instructor utilised the following in delivering their course content:

- Multiple formats such as lectures, videos and relevant audio recordings
- Highlighted important features and summaries
- Multiple media and format when engaging with material such as allowing to magnify text, allowing for changing colours of text and backgrounds and allowing for text-to-speech applications.

To engage the strategic network (Multiple means of expression), students were provided with:

- Examples of skill level performance such as example assignment and assignment rubrics
- Practising opportunities
- Relevant and continuous feedback from the instructor
- Flexible opportunities to present their skills, such as allowing web-based material, videos and pictures in the assignments.

Moreover, to engage the effective learning network of the brain (multiple means of engagement), the instructor allowed for the following:

- Various choices of material such as websites, freedom to choose own topics, and choosing own material for assignments
- Flexible levels of challenge
- Choice of learning style such as to work in a group or by themselves.

Using a survey as an outcome measure at the end of each semester, the authors found that students felt that integrating the UDL approach helped increase their interest and engagement with the course content. Additionally, students reported that providing multiple means of representing the material was the most valuable part (Smith, 2012).

The perceived accessibility of the course material by students was also measured at the University of Ontario, Canada (Kumar & Wideman, 2014). Various accessible means of representation, engagement and expression were integrated into this course for a semester of the first year of an undergraduate course. Through an in-class 20-minute

questionnaire, most of the students reported that they found the UDL-inspired tools to be useful to their learning. Some students report having more confidence and less stress due to the availability of the instructor and the prompt feedback they provided as well as the flexibility with assignment due dates and group work. Additionally, the instructor of the course reported feeling more engaged with students; however, they felt that their workload had increased due to the preparation of some of the UDL-related tools (Kumar & Wideman, 2014).

Furthermore, the use of a UDL-based curriculum was found to increase learning equity amongst university students; by providing flexibility, students with disabilities did not feel that they were treated differently from others (Black, Weinberg, & Brodwin, 2015). Black et al. (2015) applied both UDL and UDI to a university course curriculum undertaken by students with and without disabilities in South California, US. The outcome of this study was measured through student feedback during face-to-face interviews (n=15).

Students with and without disabilities rated the approach used as useful for their learning.

Clinical Placement for health sciences students was another educational context proposed to benefit from UDL principles' applications. Although this article reports the summary of a conference discussion rather than a strategy or an example, the authors highlight the need for inclusive approaches in the practical aspect of course design (Heelan, Halligan, & Quirke, 2015).

At the University of Kentucky, Lexington, KY, USA, the UDL approach was implemented in a large classroom setting (600 students) by utilising the following tools PowerPoint, lecture notes, clickers, and MindTap (Dean, Lee-Post, & Hapke, 2017). The authors surveyed students to gain their feedback about the use of the tools within a UDL framework.

Students felt their learning was positively impacted by the use of the tools.

However, students reported that they preferred tools that were accessible both in and outside the classroom (PowerPoint, MindTap), rather than in-class only tools such as clickers. Additionally, the researchers investigated the impact of the use of the accessible tools above on actual learning using objective measures. In agreement with the perceived learning, MindTaps were found to have a significant positive impact on students' outcomes in comparison to clickers, which had no significant impact (Dean et al., 2017).

Similarly, in a college course for computer programming, UDL principles were integrated into the curriculum to improve the learning experience of students learning English (Allen, Dawson, Berg, & Leveridge, 2018). In the model, instructors used past student feedback

to improve engagement. To implement Principle 1, multiple means of engagement, students were presented with the repetition of concepts in language and content lectures and labs to provide multiple opportunities for engaging with the content. Lesson plans were generated from exercises completed and produced by students working in collaboration with teacher's assistance. The instructors also focused on the level of effort by students rather than their abilities. This ensured mastery-oriented feedback. Furthermore, students were provided with self-regulation options, such as graded problem, multiple-choice questions, and online schedules.

In implementing Principle 2, multiple means of representation, students were offered interactive lectures, problem bank with example questions and scenarios, and screencast walkthroughs. To improve students' comprehension of the material, background knowledge was built up through systematic processes. As the concepts got more complex, these processes activated the required knowledge. Additionally, visual representations of problems and structures were given to students during lectures. Discussion times were allocated in tutorials to add another option of comprehending the material. Finally, in implementing Principle 3, multiple means of expression, students participated in presenting work using their own words to build understanding. They worked first on defining terms in small groups, then as the term progressed, the groups got larger and the problems more complex. Further, they were encouraged to use multiple forms of media such as overhead projectors and code editors to present their work to their peers.

Using a survey to measure student satisfaction with the course design, the authors concluded that the integration of the UDL approach improved the overall learning experience for English learners as well as native English speaking students (Allen et al., 2018).

UDL was also used to design a surgical education course in response to the Covid-19 Pandemic, which resulted in the cancellation of face-to-face classes at the Department of Surgery, Houston Methodist Hospital, Houston (Dickinson & Gronseth, 2020). To overcome the challenges of social distancing and quarantine requirements that surgical educators were faced with during the Pandemic, the UDL framework was utilised to develop an inclusive program that addressed all learners' needs. In this case study, educators used flipped classrooms, telemedicine, online educational material, question banks through open resources, YouTube videos, and Webinars to present their content. To address multiple means of engagement, residents were engaged in synchronous and asynchronous discussion sessions through text or online platforms such as Blackboard and Canvas. Meetings were attended via Zoom, Flipgrid and Microsoft Teams. Simulation labs with distancing measures and Home box Trainers such as Taskits (Caban et al., 2013) were used as means of action and expression.

A recent example of UDL application in practical medical course content was illustrated in the teaching of an Anatomy unit at University College Cork, Ireland (Balta et al., 2021). In this UDL case study, the authors demonstrate how UDL was used as an inclusive framework in medical education by providing detailed strategies and outlines of providing multiple means of representation, engagement and expression in Anatomy labs. However, the effectiveness of applying the UDL approach in Anatomy teaching was not measured.

A UDL approach was implemented in an Australian pilot project at a post-secondary college offering a foundational studies course to prepare for university admission. Students enrolled in this course were 50% low-SES and 20% non-English speaking background (Dinmore & Stokes, 2015). The authors did not specify the background of the other 30% of the students enrolled in the course.

Prior to implementing the course, teaching staff attended a workshop to ensure they were familiar with the UDL framework and its principles. There was an emphasis on consistent communication between staff and students. Students were provided with information online and offline, given rubrics and example assignments. Students were also supported to set goals and scaffolds for their achievements.

In applying multiple means of representation, similar to the examples above, the material was offered in PowerPoint, PDF and podcast format. Materials were audited prior to students starting the course to ensure that variable forms of representation were available.

For multiple means of engagement, student-centred learning and assessment approach was adopted in the course. As the students were aiming for different university courses at the end of their foundational studies, they were encouraged to develop research topics that link directly to improving their literacy in their future fields of studies.

Finally, Multiple Means of Expression and Action were achieved using clickers during lectures, collaborative tutorials, student reflection on learning, monitoring assignment progress online and offline, and formative feedback before assignment submission (Dinmore & Stokes, 2015).

This pilot enabling program is one of the few published experiences in Australia. Students from this course reported a high satisfaction level with course content, staff and blended online and offline learning.

A UDL guided Special Education online course design was also reported by researchers at Virginia Commonwealth University in the USA (Scott & Temple, 2017). In designing this distance learning course, Scott and Temple (2017) placed emphasis on communication. They reported weekly interaction sessions between peers and peers and instructors. Students were provided with an announcements page and up-to-the-minute updates. This was aimed at encouraging communication between learners and teachers as well as collaboration amongst students. The course was also divided into micro-components. The course was designed to use a subunit of Google Apps for Education service, Google Apps Platform (GAP), as it allows for sharing and adding information as well as collaboration between the students. Data acquisitions by the teachers were also more readily accessible using GAP due to compatibility with other Google products such as Google Sheets and Google forms. The courses were also divided into sections to improve the navigation through the course page. To ensure that they applied UDL adequately in their design, the authors created a table with the three principles and the strategies used by them to address each of these principles (Scott & Temple, 2017). The impact of applying UDL to this remote learning Special Education teacher preparation course was not reported in this report.

Lohmann and colleagues (2018) described an example of partially applying the UDL approach to a Special Needs teachers preparation course. The authors presented their action research approach of applying multiple means of engagement to connect with the students of the course and improve communication amongst the student cohort (Lohmann, Boothe, Hathcote, & Turpin, 2018). Students were invited to contact the instructor via multiple means, including phone calls, text messages, set weekly online office hours, Twitter chats and weekly Blackboard Collaborate course sessions. Students' perception and use of the offered means of engagement, as well as their perception of the use of UDL in the course, was surveyed. Students reported being aware of the multiple means of engagement. However, most of them only chose to use phone calls and text to contact the instructor, despite the fact that instructions were provided on how to use Twitter and Blackboard. Nevertheless, the students reported that they felt they were valued as students and better connected to their peers and the instructor. They also reported that they felt that this experience will have a positive impact on their teaching style with their students and how they would engage with the students and their families in their own teaching practice (Lohmann et al., 2018).

Another example of applying UDL at a whole institute level was illustrated by researchers at Greensboro College in the USA (Bodgan & Pass, 2018). The implementation of UDL at this college occurred in phases. In Phase 1, the exploration of UDL was made a part of the strategic plan, with administrators and educators to be involved in the implementation of UDL. In Phase 2, preparation, all staff were trained on the principles of UDL. In Phase 3, integrating, research was conducted on ways to integrate UDL in classrooms and curricula by creating long and short term goals for implementation. In Phase 4, scaling, the continuous integration of UDL in classrooms was undertaken, and students were included in the process. In Phase 5, optimisation, staff received ongoing training on the implementation of UDL throughout the campus (Bodgan & Pass, 2018). This report did not include a measure of outcomes for implementing UDL. However, the authors described a plan to measure the success through students' GPA as a next step in the project.



Limitations to Applying UDL into Tertiary Education

Limiting factors to the application of the UDL approach at the tertiary level have to be considered in order to ensure adoption of UDL and the effectiveness of the application. Some of these factors are necessary to consider when designing curricula, such as the time required by educators to make the changes (Kumar & Wideman, 2014), the cost associated with some of the technology required to apply the UDL approach into course design (Balta et al., 2021), as well as the environmental barriers such as large classroom sizes (Dean et al., 2017).

One of the points that UDL critics argue is difficult to address when integrating UDL into course design and delivery in tertiary education is instructors themselves (Morina & Orozco, 2021; Scanlon et al., 2018). From reviewing examples of applying the UDL approach to a whole faculty or an institute (Bodgan & Pass, 2018; Dinmore & Stokes, 2015), a coordinated and strategic approach is needed. The first steps involve educating and informing staff, including educators and administrators (Bodgan & Pass, 2018; Dinmore & Stokes, 2015). The UDL framework and guidelines provide educators with options and strategies to choose from, however, it remains responsibility of the educator to decide a suitable path for their course or unit (Meyer, Rose, & Gordon, 2014). The lack of training for educators creates a barrier to the rigorous implementation of UDL at the tertiary level due to the confusion, time and planning required by individual educators (Morina & Orozco, 2021).



Universal Design for Learning: Environmental Scan



Method

An environmental scan was undertaken as part of this project by conducting a comprehensive search of the internet to locate publicly available policies with reference to UDL and staff training in the UDL approach in the Australian tertiary education sector. The scan included government and tertiary education provider documents and policies, relevant to both Australian universities and the Australian Vocational Education and Training sector.

Summary of search

A number of policies were located through the environmental scan which contain reference to UDL or concepts that align with the UDL definition and principles.¹ These documents are annotated with commentary that locates them in the field and signals their wider impact or usage.

Australian Government documents with reference to UDL include:

- the Higher Education Standards Framework (Threshold Standards) 2015 which in section 2.2.1 states “Institutional policies, practices and approaches to teaching and learning are designed to accommodate student diversity, including the under-representation and/or disadvantage experienced by identified groups, and create equivalent opportunities for academic success regardless of students’ backgrounds”
- Tertiary Education Quality & Standards Agency (TEQSA) – Guidance Note: Diversity and Equity 2017 which indicates that for institutions to comply with standard 2.2.1 TEQSA will look for consideration of the diversity of their student cohort, their incorporation on equity and diversity in course design and delivery and that their policies and practice accommodate all students regardless of their background

¹ Only documents that explicitly mention UDL are included in this report, with the exception of Australian Government documents, for the purpose of identifying potential funding and support sources where UDL is aligned with the policies.

- Strategies for Using Online Invigilated Exams – TEQSA. This document provides educators with ten strategies that assist in reducing the possible risk associated with these type of exams while making most of the benefits associated with them (Dawson, 2021). UDL is referenced under Strategy number five
- Disability Support Fund (DSF) – DSF funding via the Other Grants Guidelines made under the Higher Education Support Act (2003). UDL application to course content and staff training may be eligible under activities “(3) modifications to course content, teaching materials and delivery methods to better meet the needs of students with disability; or (4) training of provider staff to support students with disability”
- The Disability Support Program (DSP) final report 2015 – This report provided an evaluation for the Department of Education Disability Support Program. The report highlighted that in 2015 most accessibility was focused on addressing the needs of individuals. It provided a recommendation to shift the practice to a more accessible approach by applying the principles of UDL (KPMG, 2015).
- Access to real learning: the impact of policy, funding and culture on students with a disability (Senate Standing Committee on Education and Employment, 2016). The Committee recommended that the Australian Government should ensure that educators and staff are supported to access inclusive education skills and listed UDL as one of the approaches in this recommendation.
- Disability Standards for Education (2005) 2020 Review – Final report: In this review of the standards, the Department of Education discussed the need for UDL principles to be applied to curricula to make educational material accessible to all in the review of Standard 2.2.10. However, UDL was not recommended or reinforced by the standards in the development of curricula in the VET and Higher Education sectors (Department of Education Skills and Employment, 2021).

Australian University documents and policies with reference to UDL include:

- Central Queensland University: [Students Participation, Retention and Success - Guidelines Principles and Strategic Directions 2019-2023](#). UDL is listed as one of the commitments of the university to inclusive education.
- University of New England: [Accessibility Action Plan, June 2020 – June 2021](#). UDL is listed as an objective for the university to achieve in order to increase the participation and success of students and staff with a disability.
- The University of Sydney: [Disability Inclusion Action Plan 2019-2024](#). UDL is referenced in the document.
- Victoria University: [Student Accessibility Action Plan 2021-2023](#). UDL approach was referenced as a central part of the commitment of the university to accessible learning.

- RMIT University – [Accessibility Action Plan](#) lists the continuation of promoting the knowledge and culture of Universal Design as one of its targets in teaching and learning.
- Flinders University: Tipsheet – [Design principles for creating engaging digital content](#). Includes seven tips on how to apply the principles of UDL.
- Swinburne University: [Canvas Standards guide](#) recommends UDL as an approach to design curriculums on Canvas rather than focus on accommodating for disability.
- The University of Notre Dame: [Online Learning: Universal Design for Learning practice guide](#) provides a description of the principles of UDL with suggestions of strategies of how to apply each of the principles to curricula.
- Deakin University: [Inclusive Education Principles](#) – outlines ways in which the Deakin University community creates a meaningful, welcoming and engaging environment (both on campus and in CloudDeakin) for all its students, to facilitate equitable and successful participation. These principles incorporate findings from key research including the [Universal Design for Learning](#) (CAST 2018) framework.

Australian Vocational Education and Training (VET) Sector documents and policies with reference to UDL include:

- Australian Skills Quality Authority (ASQA) – [Fact Sheet - Providing quality training and assessment services to students with disabilities](#). In this document, ASQA references UDL as a strategy to be accessed through the Australian Disability Clearing House on Education and Learning website (ASQA, 2016).
- GoTAFE – Victoria: [GOTAFE Reasonable Adjustment Plan 2018 – 2021](#). GoTAFE lists improving awareness of Universal Design principles as one of the actions taken to reduce barriers to individuals with a disability from accessing good services.
- Harrison Training Group – [Reasonable Adjustment in teaching, learning and assessment for learners with a disability A guide for VET practitioners](#), a document by the Queensland VET Development Centre-Research and Strategy, was referenced by Harrison Training group. In this guide, UDL was mentioned as a guiding principle for reasonable adjustments for learners with disabilities (Queensland VET Development Centre - Strategy and Research, 2010).
- Department of Employment, Small Business and Training Queensland - [Reasonable Adjustment in Teaching, Learning and Assessment for Learners with Disability](#) recommends UDL be considered by VET educators when designing their course curricula.

- PwC’s Skills for Australia - Inclusion of People with Disability in VET Cross Sector Project Environmental Scan examined the participation of people with disability in education, training and employment. It also examined the challenges and barriers people with disabilities facing in the employment and education context, as well as gaps in the skills of educators and employers in the VET sector (PwC, 2018). UDL was identified in this environmental scan as a potential strategy to build skills and knowledge to “address the ‘how’ of disability”. Furthermore, this document also identified a potential gap in VET educators’ skills in implementing inclusion strategies such as UDL and that providing training in UDL could assist in addressing this skill gap. This document also recommended UDL to be introduced to educators in the VET sector as part of common units and training packages.
- TAFE SA: [Disability Access and Inclusion Plan 2020-2024](#) lists developing and promoting the Principles and Guidelines of UDL as one of its actions
- The Gordon Institute of TAFE – [Disability Action Plan 2018-2021](#) lists Universal Course design as an action required to achieve excellence in teaching and learning.

Tertiary Education Sector Advocacy and Peak Body documents with reference to UDL include:

- Australian Disability Clearinghouse on Education and Training (ADCET) [submission](#) to the Disability Standards for Education (2005) 2020 Review highlighted the significant interest in UDL of visitors to the ADCET website since 2015. ADCET emphasised that UDL principles need to be implemented in tertiary education in order to reduce the need for individual adjustments for people with disability.
- Australian Tertiary Education Network on Disability (ATEND) [submission](#) to the Disability Standards for Education (2005) 2020 Review recommends that implementation of UDL be reinforced in the Standards in order to minimise the need to retrofit accessibility to already existing curricula. Further to this, ATEND recommended reinforcing UDL Principles in the education publishing industry to ensure education material is accessible to all students.

UDL was referenced on relatively few Australian Vocational Education and Training (VET) provider or Australian university websites. Available materials predominantly included fact sheets, practice guides, blogs, training videos and links to external resources such as the [UDL Curriculum toolkit](#) by CAST.

International Examples of UDL framework

Example of UDL in VET/FET

A Conceptual Framework of Universal Design for Learning (UDL) for the Irish Further Education and Training Sector (Quirke & McCarthy, 2020) from the Association for Higher Education Access & Disability (AHEAD).

The goal of the framework is to make UDL intentional in all the delivery of Further Education and Training (FET). This framework is unique in its design as it specifically addresses the needs and the challenges of the FET sector.

Instead of implanting UDL principles directly into the framework, the authors included another vital factor of the curriculum delivery in the FET sector, the educator. Therefore, the “who” is added as a fourth principle to the multiple means of Representation “what”, the multiple means of Engagement “how”, and the multiple means of Expression “why”. In doing so, this conceptual design recognises the diversity of the FET educators and the environments in which they practice. It also recognises the importance of collaborative, reflective practice by the educators to allow for the consistent and adaptable implementation of UDL.



This conceptual framework is proposed to have three stages:

1. Understanding that the philosophy and practice is one of inclusion. An inclusive education pyramid is used to illustrate that UDL is intended for all users. UDL is implemented for the general population of the classroom, then accommodation is added according to the need of the learner.

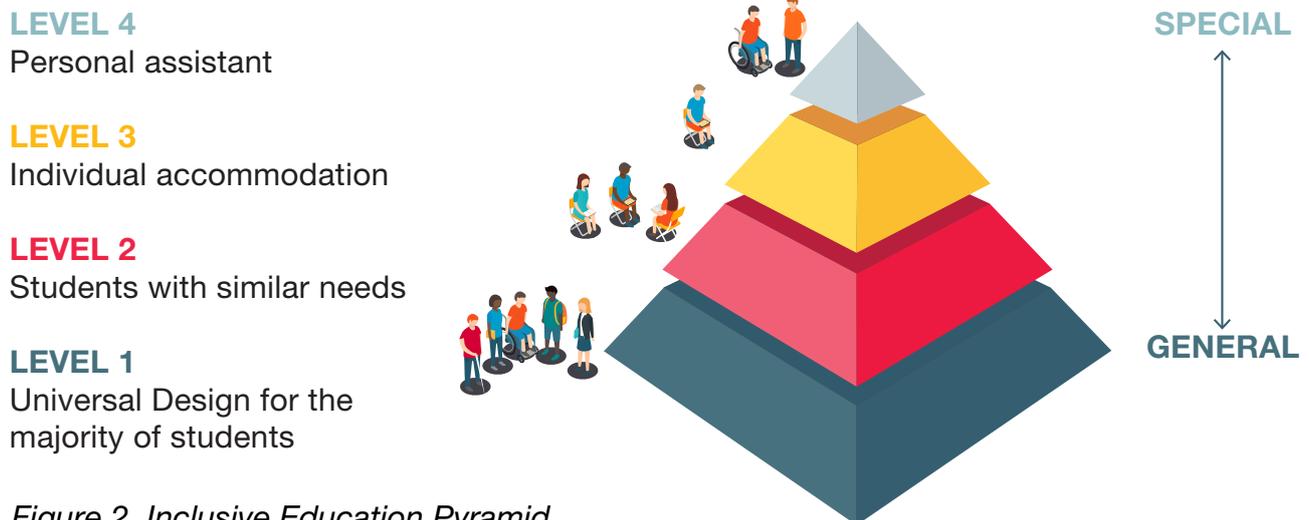


Figure 2. Inclusive Education Pyramid (Quirke & McCarthy, 2020).

2. Appreciate the design of UDL by implementing the main three principles of UDL
3. Identify 'who needs to be involved – recognising the importance of the engagement of the instructor in the FET sector.

[This project](#) was presented in ATEND online conference Pathways15 in 2020 by (Roisin, Heelan, & Tobin, 2020).

Examples of UDL in Higher Education

Universal Design for Learning in Higher education is a framework that is published by the Taylor Institute for Teaching and Learning at Calgary University, Canada (La, Dyjur, & Bair, 2018). The authors of this document give an overview of UDL principles with tables of examples on each. They also provide reflection questions for instructors and question sheets to identify what UDL practice the instructor already has in practice.

The document then provides a flowchart of strategies of how UDL can be implemented in a university course (Figure 3), followed by another worksheet for a UDL planning activity. This document also provides examples of how to incorporate UDL in lectures.

Examples of Strategies to Implement UDL in Your Course

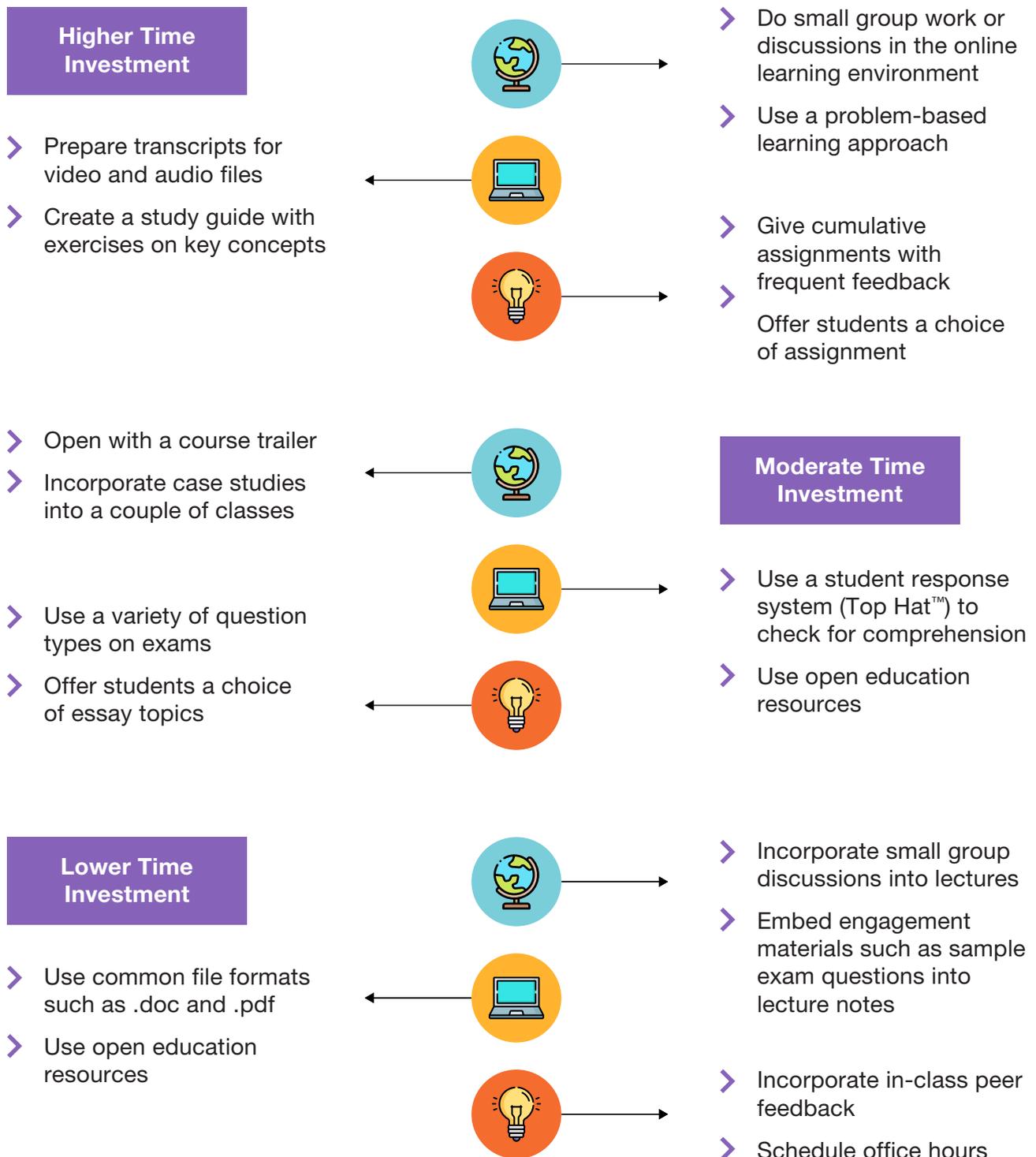


Figure 3. Examples of strategies to implement UDL in university course (La et al., 2018).

Implementing Inclusive Teaching and Learning in UK Higher Education – Utilising Universal Design for Learning (UDL) as a Route to Excellence (Martin et al., 2019). This report explores the level of UDL implementation in the higher education sector in the UK ahead of the reforms to the Disabled Students Allowance by the Higher Education Sector in the UK.

This report identified the necessity of involving all staff that are responsible for students' experiences in effective implementation of UDL. It also identified the inconsistencies of UDL principles application between a whole institute level and a micro/course level. Another interesting point raised in this report is that in the UK, staff training in UDL is elective, and only a few staff attend with a clear absence of executive level attendance.

The authors conclude that UDL application at an institute level could be beneficial to all, not only students with disabilities.

UDL will reduce the adjustment required to accommodate some groups and individuals by making material accessible to all (Martin et al., 2019).

The International Collaboratory for Leadership in Universally Designed Education (INCLUDE) is a centre of research hosted by the University of Worcester, UK, that focuses on the effective application and improving the understanding of inclusive education and UDL in higher level education. INCLUDE steering committee comprises six academics from around the world who have strong commitment and expertise in inclusive education and UDL.

INCLUDE aims at providing principles and practices of inclusive educations at the institutional level internationally. INCLUDE website has a wide range of tools that enables educators to apply UDL to their curricula, including tech tools, link to the CAST website and online courses. It also offers strategies to create accessible curricula, assessment and app designs.

[INCLUDE Collaboratory](#) is working on offering a master's program in UDL that universities can offer internationally.

Other Available Resources and Publications

- **Creating Inclusive Learning Opportunities in Higher Education: A Universal Design Toolkit** – book (Burgstahler, 2020). In this book, the author develops a framework for Universal Design in Higher Education based on three approaches, with the principles of UDL used as one of the sources for the framework design. The book then guides the users of the framework on how to apply it in a physical environment, technology, teaching and learning. Finally, the author proposes a model of inclusive campus-based on her approach of Universal Design in Higher Education.

- **Transforming Higher Education Through Universal Design for Learning: An International Perspective** – (Bracken & Novak, 2019). This book provides insight into UDL current practices, application and research from leading practitioners and researchers from Australia, Belgium, Brazil, Canada, Ireland, Israel, Norway, South Africa, Spain, the UK and all across the USA. By looking through an international lens, the authors are able to consider the impact of UDL applications on a diverse group of learners (e.g. socioeconomic, age, ethnic groups and disability) and explore strategies for implementing UDL successfully in higher education.

- [How to Talk to Your Colleagues About Universal Design for Learning](#) – Video keynote presentation from ATEND Pathway15 online conference (Tobin, 2020).

In this presentation, Tobin encourages higher education teachers to start a conversation with their employers about the benefits of applying UDL campus-wide to reduce cost, improve student participation and retention and promote equity on a whole institution level.

- [Inclusion Through Universal Design for Learning](#) – Video presentation from ATEND Pathway15 online conference (Kennedy-Wood, 2020).

The speaker presented strategies and tools of enabling and promoting inclusion through multiple means of Engagement, Representation and Expression.

- **[Addressing Accessibility & Usability](#)** – a workshop offered by Quality Matters (QM) organisation. This course aims at providing insight into UDL to assist in creating accessible educational content.

QM is a non-for-profit international organisation that provides quality assurance for online courses by providing an evidence-based review, suggestions for improvements and certification of quality. QM has a [Higher Education Publisher rubric](#) that includes 41 standards. There are eight general standards to the rubric, with the eighth being “Accessibility and Usability”, which utilises the UDL principle to assess the accessibility of online material.



Discussion



Universal Design for Learning is a flexible educational framework that aims to eliminate the barriers to learning by making educational material accessible to the largest number of students.

This Literature Review and Environmental Scan identified that UDL in Australia appears in only a small number of policies and tertiary institute websites, likely attributed to lack of reinforcement in Government policies in higher education and VET, and subsequent slow adaptation of UDL in these sectors.

Whilst individual examples of implementing the UDL approach in higher education have been published, only a few examples of applying UDL at an institute level are available in the literature.

Some Australian policies were identified which contain reference to UDL or concepts that align with the UDL definition and principles, though these were referenced on relatively few Australian Vocational Education and Training provider or Australian university websites. Evidence emerged supporting the effectiveness of UDL application in tertiary education, with multiple examples demonstrating the successful integration of UDL principles into college and university curricula, however with the majority of these being international examples.

International examples demonstrated that effectiveness of UDL application occurs when there is a whole of faculty or institute approach, and where faculty members are educated in its application.

In Australia however, there is a lack of UDL training available for educators. Whilst the UDL framework and guidelines provide educators with options and strategies to choose from, it remains the responsibility of educators to design their courses inclusively.

However, across tertiary institutions there remains inconsistent application of UDL principles. In addition, limiting factors, such as time, cost and technology to the application of the UDL approach at the tertiary level have to be considered in order to ensure the effectiveness of the application and are necessary to consider when designing curricula.

Despite the various definitions of UDL that appear in the literature, the general understanding of UDL remains consistent as a set of principles with an emphasis on flexibility which provides educators with a framework that allows for multiple means of learner's Representation, Engagement and Expression. Coursework design that inherently accounts for accessibility and universal design, rather than 'retrofitting' accessibility to materials as required will benefit all students and enable disability practitioners to focus on facilitating reasonable adjustments for students with higher support needs.



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