Universal Design for Instruction in Postsecondary Education: A Systematic Review of Empirically Based Articles

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Abstract

Universal Design for Instruction (UDI) in postsecondary education is a relatively new concept/framework that has generated significant support. The purpose of this literature review was to examine existing empirical research, including qualitative, quantitative, and mixed methods, on the use of UDI (and related terms) in postsecondary education. The criteria used to select articles included in this review were: (a) empirical studies in peer-reviewed journals, (b) articles published in 2000 or after, and (c) articles on the use of UDI, Universal Design for Learning (UDL), Universal Instructional Design (UID), and Universal Design (UD) in postsecondary education settings. Eight articles met the search criteria. This limited number of empirically based articles led to the conclusion that more research needs to be conducted on the use of UDI in postsecondary education. The primary recommendation for future research is to operationalize the principles of UDI and investigate its impact on the outcomes of postsecondary education students with and without disabilities.

Diversity in postsecondary education has expanded over the past two decades, creating a need for colleges and universities to reassess traditional instructional strategies to better meet the needs of all students (Newby, 2005; Scott, McGuire, & Shaw, 2003). As reported in the *Chronicle of Higher Education* (2008), this increase in higher education diversity includes (a) 35.35% of students being of minority status, (b) 11.3% of students reporting a disability, (c) 45.3% of students attending part-time, and (d) 21.5% of students being ages 25 to 34 with 18.4% being over age 34.

This increasingly varied student body presents diverse learning needs often not addressed through traditional instructional approaches in higher education (e.g., lecture). Many recent principles for designing instruction and instructional environments to address student diversity have been based on the principles of Universal Design (UD). This article presents the background and history of UD principles and how they became applied in postsecondary education. This is followed by a discussion of terminology, and a presentation of the method used to conduct a systematic review of the empirically based, peer-reviewed journal articles on UD for learning/instruction in postsecondary education. The article concludes with the results and discussion of the systematic review, limitations of the review, and conclusions.

Background and History of UD Principles

Universal Design began to be considered in the 1950s in Europe, Japan, and the United States and focuses on removing physical and environmental barriers (e.g., providing flat entries to buildings designed with stairways leading to the entry and lowered ATM machines reachable by individuals of various heights) that prevent access for individuals with disabilities. In the 1970s, the concept of UD evolved from one of removing physical barriers to people with disabilities to integration of all people within all environments. This evolution coincided with passage of legislation encouraging and mandating civil rights for individuals with disabilities, including the Architectural Barriers Act of 1968, the Rehabilitation Act of 1973, and the Education of the Handicapped Act of 1975 (now Individuals with Disabilities Education Improvement Act). The Rehabilitation Act of 1973, which included Section 504, the first civil rights legislation about disability, is especially important in the history of UD because

it mandated physical access in buildings for any U.S. program receiving federal funding. With the passage of the Americans with Disabilities Act (ADA) of 1990, UD expanded to public and private facilities and no longer depended upon entities receiving federal funds. Title III of the ADA specifically emphasizes access to public facilities. The late Ron Mace, founder of the Center for Universal Design in North Carolina and an architect with a disability, identified with, defined, and popularized UD. Mace once commented that UD is a "commonsense approach to making everything we design and produce usable by everyone to the greatest extent possible" (Institute for Human Centered Design, 2008). The Center for Universal Design published seven principles applicable to environmental accessibility (Connell et al., 1997):

1. Equitable use: Design should be usable and marketable to diverse individuals. For example, a curb cut that someone riding a wheelchair, a parent pushing a stroller, a bike rider, and a delivery person can use and benefit from.
2. Flexibility in use: Design accommodates preferences and abilities. For example, scissors usable by someone who is right-hand dominant and someone who is left-hand dominant.
3. Simple and intuitive use: Easily used by individuals of diverse knowledge, literacy levels, and background experiences. For example, a menu using both language and pictures.
4. Perceptible information: Information is provided with ease of use regardless of sensory needs. For example, elevators that have buttons for each floor available at wheelchair height, in Braille, and with sound as each floor is passed.
5. Tolerance for error: Consequences or potential hazards are minimized. For example, automatically saving computer documents while in the process of writing.
6. Low physical effort: Design can be used comfortably and with minimal effort. For example, a levered door handle, as opposed to a knob.
7. Size and space in approach and use: Design accounts for users of different shapes, sizes, and agility. For example, accessing an office mailbox from a sitting or standing position with minimal reaching effort.

UD in Postsecondary Education

Historically the seven UD principles promoted architectural and environmental designs to enhance accessibility and usability for as many people as possible. In the past decade, educators have expanded these principles to include educational access. This expansion is supported in recent legislation including the Reauthorization of the Higher Education Opportunity Act, 2008, where UD is referred to eighteen times. One such reference, which is found in SEC. 762 (G) – "Making postsecondary education more accessible to students with disabilities through curriculum development, consistent with the principles of universal design for learning" is indicative of the future of UD in higher education - A future that began, in part, in 2001 when Shaw, Scott, and McGuire published nine principles of UD for instruction (UDI). These nine principles applied the seven UD principles of Connell et al. (1997) to postsecondary education instruction and added two additional principles - Principle 8: A community of learners, and Principle 9: Instructional climate. Examples based on these nine principles include:

1. Equitable use: Accessing course information, such as syllabi, in a variety formats, including print, disk, and online.
2. Flexibility in use: Varying instructional methods, including lecture, discussion, and individual and group activities.
3. Simple and intuitive: Clearly describing course expectations for grading, in different formats, for example narrative and rubrics.
4. Perceptible information: Using videos that include subtitles, or captioning, for those who may not hear, for whom English is not a first language, or for those who have trouble processing verbal information.
5. Tolerance for error: Providing ongoing and continual feedback on coursework rather than at specified interim periods, such as mid-term or final exams.
6. Low physical effort: Providing lecture notes, so students who have difficulty taking notes do not need to take notes.
7. Size and space for approach and use: Making seating easily accessible, if possible, so everyone can see each other and communicate with one another directly. Circular seating may address this principle.
8. Community of learners: Creating a variety

of learning settings, for example, use of e-mail groups, social networking sites, or chat rooms.

9. Instructional climate: Including a statement in the syllabus indicating the desire to meet the instructional needs of all students and for students to convey their needs to the instructor.

In summarizing the nine principles of UDI, one can describe them as presenting multiple means of representation, engagement, and expression (Center for Applied Special Technology, 2008).

Although UDI is a relatively new framework in postsecondary education, it has generated significant support. For example, Newby (2005) suggested approaches based on UDI "bring flexibility and creativity to instructional delivery and management" (p. 600), stating the framework "allows our students to gain knowledge by taking advantage of their strengths" (p. 601). Rickerson and Deitz (2003) advocated the use of UDI principles in occupational therapy education, noting UDI is in line with the values of their profession.

In addition, organizations have recognized the importance of UDI. For example, the Association on Higher Education And Disability (AHEAD) published an entire journal (i.e., *Journal of Postsecondary Education and Disability* Vol. 19, Issue 2) dedicated to UD in higher education (Ofiesh & McAfee, 2006). As indicated previously, UD is written into the Higher Education Opportunity Act of 2008 where it is described as a "scientifically valid framework for guiding educational practice" SEC. 762 (G) (SEC. 103 (C)). Inclusive and accessible postsecondary education is an exciting prospect and one that UDI is purported to help obtain. This literature review is designed to provide an understanding of the research that supports this claim while providing evidence to justify the ongoing use of UDI in postsecondary education settings.

Terminology

As indicated, UD principles are being applied to educational settings. This has brought about the use of a variety of related terms, in literature, to describe these efforts. Three of the most prominent terms are UDI, UDL, and Universal Instructional Design (UID). Some researchers appear to use these terms interchangeably (e.g., Koch, Hennessey, Ingram, Rumrill & Roessler, 2006), whereas others describe distinctions among them (e.g., McGuire & Scott, 2006). Despite the different terms, each refers to the application of UD principles in the instructional environment. Accordingly, we used all three terms while conducting the literature review. However, to avoid confusion, the term UDI is used throughout this article and encompasses all similar terminology.

Method

Criteria

The criteria used for selection of articles included in this review were those articles published (a) as empirical studies in peer-reviewed journals, (b) in 2000 or after, and (c) on the use of UDL, UDI, UID, and UD in postsecondary, college, university, and higher education settings. These criteria were chosen since the intent of the systematic literature review was to identify and review research on the use of UD in postsecondary education settings. The year 2000 was established as a starting point based upon the fact that in 2001, Shaw, Scott, and McGuire published the nine principles of UDI.

Data Sources, Collection, and Analysis

To locate peer-reviewed research articles (qualitative, quantitative, and mixed methods) that met the criteria, four electronic databases, ERIC, PsychInfo, Academic Search Premier, and Social Sciences Citation Index, were searched. Each of the four terms most commonly used for UD in an educational setting (i.e., UDL, UDI, UID, and UD) in combination with "Postsecondary," "Higher Education," "University," or "College," were used to create sixteen identifiers, as shown in Table 1. The table presents the total number of articles located in the search. The number of articles initially retrieved from the electronic search is presented in the first column, "Initial." From this pool of articles, we reviewed abstracts and screened articles to discern which ones fit the established criteria. We then reviewed each of the screened articles to determine if they were empirically based. This result is presented in the second column, "Final." After excluding articles duplicated across the four search engines, a total of eight articles met the three criteria for inclusion in the review.

Table 1

The Number of Peer Reviewed Articles Published Since 2000 on UDL, UDI, UID, or UD in Postsecondary, College, University, or Higher Education Settings

	Peer Reviewed Empirical Articles from 2000 - 2009	ERIC		Academic Search Premier		Psychinfo		Social Sciences Citation Index	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final
	Postsecondary	3	1	1	0	4	0	2	0
U	College	10	4	17	1	13	1	3	1
D	University	10	4	17	1	32	1	5	1
L	Higher Education	6	3	2	0	3	0	3	1
	Postsecondary	3	2	2	0	4	0	2	0
U	College	5	3	4	0	9	0	2	0
D	University	5	3	4	0	10	0	0	0
I	Higher Education	5	3	3	0	3	0	1	0
	Postsecondary	4	0	4	0	2	0	0	0
U	College	3	0	8	0	2	0	0	0
I	University	3	0	8	0	7	0	1	0
D	Higher Education	6	0	3	0	3	0	1	0
	Postsecondary	18	3	5	0	5	0	2	0
U	College	37	7	87	2	48	1	9	1
D	University	37	7	87	2	240	1	22	1
	Higher Education	29	6	11	1	9	0	15	1

Results

Table 2 provides a summary of the eight articles that met the search criteria and were thus included in this review. The articles were organized by research methodology: quantitative (experimental design), qualitative (focus group, action research, case study, or survey), and mixed methods.

Quantitative Using True Experimental Design

Through the extensive literature search one true experimental study was found. Spooner, Baker, Harris, Ahlgrim-Delzell, and Browder (2007) investigated the effects of a one-hour training on how to apply UDI principles to lesson plans for students with disabilities (SWDs). The subjects were 72 graduate and undergraduate students enrolled in two special education and two general education college classes. At baseline no participants had previously written a lesson plan applying UDI principles. Subjects were randomly assigned to either the intervention group or the control group. Before and after the training, both groups were asked to develop a lesson plan based on a case scenario. The lesson plans the subjects designed during the pre-test and post-test were scored using the same rubric, and the total scores, representation scores, expression scores, and engagement scores were calculated for both pre- and post-tests. Pre- and post-scores were compared by group (i.e., experimental vs. control) and class (i.e., general education vs. special education). The result of a three-factor analysis of variance with repeated measures indicated significant differences between pre-test and post-test scores for both intervention groups of special education and general education teachers. Based upon the results, the authors suggested that even a simple training could improve the ability of postsecondary students, preparing to be special and general education teachers, to develop accessible lesson plans for all students including SWDs.

Qualitative Studies Using Focus Groups, Action Research, Case Study, and Surveys

Through the literature search, six qualitative studies were found. The first qualitative study by Embry, Parker, McGuire, and Scott (2005) consisted of two focus groups with a total of 16 postsecondary disability service providers. The study was designed to assess their perceptions related to the following areas: strengths and weaknesses of the UDI framework in improving inclusive teaching, the role of faculty in promoting UDI, and supports needed from student disability services to implement UDI. Disability service providers listed several strengths and weaknesses of UDI. Strengths included the ability to interact more fully with a diverse student body. Weaknesses primarily related to the need to transition from current practice and resources to more universally designed ones. Respondents reported they had a role in the promotion of UDI on their campuses. They also reported the perception that the need for disability services would likely decrease if UDI was broadly implemented. Supports indicated as being important to the implementation of UDI included more information on UDI, support of campus leaders, and ability to influence institutional change.

McGuire and Scott (2006) conducted the second qualitative study which consisted of four focus groups with a total of 23 postsecondary students with learning disabilities. The purpose was to use focus groups as a means to explore the validity of UDI as a new construct. The focus groups sought to obtain student opinions and perceptions about the attributes of a good college course, teaching methods and strategies that promoted learning, and the challenges and barriers experienced in college courses.

Instructional methods described by the student participants that make up a "good" college course included: clear expectations, organizational materials such as course outlines and study guides, information presented in multiple formats (e.g., lecture with visuals), affirmative classroom experiences, associating information with aspects of real life, frequent formative feedback, supportive of diverse learning needs, and effective assessment strategies (e.g., well-designed exams).

Student perceptions of good teaching methods and strategies that promote learning (i.e., good instruction/good instructor) included the following as related to the instructor: (a) approachable and available, (b) focused on the subject (not tangential to the topic), (c) enthusiastic about teaching and making personal connections with students, and (d) ambitious in their expectations for student performance. The authors noted that participant reports regarding attributes of high quality college courses and instructors parallel the guiding principles of UDI.

In the third article reviewed, McGuire-Schwartz and Arndt (2007) reported on two qualitative studies; they explored how postsecondary students who enrolled in an early childhood teacher education

Table 2

List of UDI Articles

Authors (Year)	Methodology	n	Summary of Findings
Spooner, Baker, Harris, Ahlgrim-Delzell, & Browder (2007)	True Experimental Study -Subjects randomly assigned to treatment or control group. Intervention was a 1-hour lecture on how to modify lesson plans for SWDs using UDL.	72	Pre- and post-test comparison on creating a lesson plan for SWDs showed a significant improvement of the treatment group, supporting the intervention effect.
Embry, Parker, McGuire, & Scott (2005)	Focus groups - DSPs discussed perceptions and beliefs regarding (1) strengths and weaknesses of UDI, (2) their role in promoting UDI, and (3) supports needed to implement UDI.	16	(1) UDI provides the ability to interact more with a diverse student body. (2) Need for transition from current practice and resources to more UD ones. (3) DSPs have a role in the promotion of UDI on their campuses. (4) Requests for disability services would decrease if UDI was broadly implemented. (5) More information on UDI, support of campus leaders, and ability to influence institutional change are needed to support UDI.
Harper & DeWaters (2008)	Survey - University based webmasters evaluated the accessibility of their institution's homepage website from the perspective of UDI.	12	12 university webmasters evaluated their institutional homepages for accessibility using Watchfire® Bobby™ freeware. All but one failed to meet the total criteria for accessibility, indicating that the majority of homepages were not UD.
McGuire-Schwartz & Arndt (2007)	Study 1: Action research - Early childhood teacher candidates implemented a UDI strategy.	36	UDI strategies improved learning and accessibility for both struggling and non-struggling students.
	Study 2: Case study - Focus group, interviews, a survey, a questionnaire, lesson plan review, & document analysis.	5	UDI strategies improved student learning and engagement while meeting diverse student needs and making education more inclusive and effective.
McGuire & Scott (2006)	Focus groups - To validate UDI four focus groups investigated the perceptions of SWDs on attributes of a good college course, teaching methods and strategies that promote learning, and challenges and barriers experienced.	23	In the analysis of focus group data, the perceptions of SWD parallel the guiding principles of UDI, and the findings supported the validating efforts of the use of UDI for SWD in postsecondary education.

(Table 2 continued on next page)

Zhang (2005)	Case study – PD on UDI for college faculty, school teachers, and pre-service teachers & their perceptions of the PD	70	Participants acknowledged the benefits of UDI and the need to change their teaching methods to better address the diverse needs of their students.
Parker, Robinson, & Hannafin (2007-2008, Winter)	Case study - Documentation of the re-design of a large core course in special education for undergraduates using UDI in conjunction with adult learning theories.	114	The analysis of student online interactions and course evaluations supported the use of UDI and adult learning theories, including students' higher satisfaction with the redesigned course than other courses offered in the department and other undergraduate courses.
Izzo, Murray, & Novak (2008)	Study 1 (Needs Assessment) Survey – Instructional climate Faculty and teaching associates indicated they needed more information on UDI. Based upon this finding, a web-based, self-paced PD tool was developed and evaluated.	271	Faculty and teaching associates indicated they needed more information on UDI. Based upon this finding, a web-based, self-paced PD tool was developed and evaluated.
	Focus Groups	92	
	Study 2 (Field Test) Survey	98	Faculty and administrators assessed the PD course. In terms of UDI the PD was found effective for increasing their comfort in meeting the instructional needs of SWDs.

Note. SWDs = Students with Disabilities, PD = Professional Development, DSPs = Disability Student Service Providers, n = Sample size

program understood principles of UDI and how they implemented the principles in lesson plans, teaching, and assessment during their practicum. The first study documented how 36 teacher candidates at a private college grew as practitioners-researchers using UDI intervention strategies through action research for two semesters. During the pre-practicum semester, the participants learned UDI and action research, observed students and teachers in the classroom where they would be student teaching, identified problems, developed intervention strategies using UDI principles, and planned data collection. During the practicum semester, they implanted the UDI infused strategies, collected and analyzed data, presented their findings in a poster presentation, and wrote papers. Through the action research, the participants found the UDI strategies improved learning and accessibility for both struggling and non-struggling students.

The second study was a collection of qualitative case studies in which five teacher candidates at a public college were studied during their first practicum semester. After learning UDI, the participants observed classes, identified students' learning styles, developed lesson plans using UDI strategies that reflected student learning styles, and implemented the lessons. While providing consultation to the participants regarding UDI, the authors conducted a focus group and individual interviews, administered a survey and a questionnaire, reviewed the participants' lesson plans, and analyzed related documents. Outcomes included participants' perceptions that UDI strategies improved student learning and engagement while meeting diverse student needs and making education more inclusive and effective.

Zhang (2005), in the fourth qualitative study reviewed, described a case of a year-and-a-half long teaching/learning project. The project was a collaboration between a college of education and a professional development partner school that initiated and implemented UDI for school teachers, pre-service teachers, and college professors. The project consisted of summer institutes, university workshops, preservice training, and UDI labs that served more than 70 individuals. From the analysis of participants' feedback on the project, Zhang found that as a result of the project, the participants could acknowledge the benefits of UDI and the need to change their teaching methods to better address the diverse needs of their students.

The fifth qualitative study reviewed (Harper & DeWaters, 2008) was a survey of members of a "University Web Developers' Mailing List." The intent was to assess web-based accessibility. This included UDI because websites, in order to be fully accessible, must integrate several of the principles of UDI (primarily numbers 1 and 6). For example, a website with pages or documents that cannot be viewed with a screen reader would not be accessible and thus are not UD. An instructor could not use that website in a course designed with UDI in mind. In the study of Harper and DeWaters (2008), university web developers were invited to use Watchfire® Bobby™ freeware to evaluate their institutional homepage for accessibility. Twelve individuals evaluated their campus websites. All but one failed to meet the total criteria for accessibility. Even for those webmasters who understood and wanted to follow web accessibility mandates (i.e., UDI principles), the combination of presenting both an accessible and high quality website in conjunction with budget constraints prevented them from doing so. The authors concluded that further research and a better understanding of the patterns of compliance are needed which will hopefully increase web accessibility.

The sixth study, by Parker, Robinson, and Hannafin (2007-2008) documented a case of modifying a large core course in special education for undergraduates at a public university by employing UDI principles and adult learning theories. They analyzed 114 students' on-line interaction, discussion, and course evaluations. In this study, the UDI principles were used to develop predictable and accessible instruction for individuals with diverse abilities, address their varied learning pace and prerequisite skills, minimize nonessential physical effort, stimulate student interest and attention by presenting information in different mediums, and create a welcoming and inclusive instructional environment. Student evaluations indicated the course was better than other courses offered in the department and other undergraduate courses, including their particular appreciation for making course materials available online. Based on the positive student perception of the course, the authors suggested that UDI in combination with adult learning theories could "create positive solutions for many of the challenges inherent in a large, lecture-driven 'core' classroom environment" (p. 63).

Mixed Methods

Izzo, Murray, and Novak (2008) discussed how to apply and use UDI from the perspectives of faculty,

teacher assistants (TAs), and administrators in two multi-year (1999-2006) studies using both qualitative and quantitative methods. The first study assessed instructional climate through a quantitative survey of 271 faculty members and TAs and 12 qualitative focus groups with 92 faculty members and TAs. From the first study, a faculty need for more professional development on UDI was found. In response to it, a curriculum including teaching modules for faculty and administrators was developed and piloted. Universal Design for Instruction was used to enhance both the format and content of this curriculum. In the second study, 63 faculty members and administrators evaluated the curriculum, through a quantitative survey and a qualitative questionnaire. The pre-post data collected from the participants who used the curriculum indicated that 31% of the respondents reported a moderate or very high degree of knowledge prior to using the UDL curriculum. This percentage increased to 83% after use of the curriculum. The findings indicated that both faculty and administrators are attuned to higher education's increasing diversity and the need for multimodal instruction.

Discussion

The existing peer-reviewed empirical research journal articles on UDI in postsecondary education settings appear to reflect the initial stages of a nascent literature base. Although the authors of the articles reviewed promoted the use of UDI in postsecondary education for educating pre-service teachers (McGuire-Schwartz & Arndt, 2007; Spooner et al., 2007; Zhang, 2005), training faculty members (Izzo et al., 2008), improving web accessibility (Harper & DeWaters, 2008); and presented the viewpoints of students and service providers as evidence of the effectiveness of UDI use in postsecondary education (McGuire & Scott, 2006; Parker et al., 2005; Parker et al., 2007-2008), there is very little research to support its effectiveness as a means to improve postsecondary student outcomes, such as GPAs, retention rates, and graduation rates. In addition, 6 of the 8 studies employed qualitative methods, which limits generalization of the findings. Studies using experimental designs and mixed methods approaches are clearly lacking.

Another point of interest is the lack of research on the use of existing and emerging technologies that may align with the principles of UDI. Technology can be a critical tool for creating inclusive classrooms providing for great flexibility in instructional format and expanding access to resources that benefit many learners. Examples of such technologies include text-to-speech software, wikis, Facebook, screen readers, and avatars. The authors speculate that intervention/outcomes research on these types of technologies and other specific practices (e.g., the pause procedure) aligned with the principles of UDI has been conducted. However, we also speculate that these articles did not surface in the literature search because those authors did not use the terms UD, UID, UDI, or UDL in reporting their research. This leads one to conclude that more work needs to be done to operationalize the principles of UDI so that activities that are aligned with UD principles are recognized as such.

For example, the principle of equitable use can be operationalized and investigated if text (e.g., a textbook) is presented in electronic, recorded, and text based formats. A comparative study could be conducted to determine greatest effectiveness of each method of text presentation for individuals with specific disability types. Not only will this lead to a better alignment between UDI principles and UDI interventions it will also provide for more evidence-based effective and specific UDI strategies that can be used in postsecondary education settings.

Limitations

There are several limitations to this review that merit discussion. One is the possibility that we did not locate all empirical research articles related to UDI in postsecondary settings because those authors used terms other than UDI, UDL, UID, and UD to describe their research. Furthermore, researchers may have investigated aspects of UDI, UDL, UID, and UD consistent with the principles of UDI but did not refer to them as such. In addition, research that was not published in peer-reviewed journals was not included in this review.

Recommendations

Based upon the literature reviewed we have the following recommendations:

- Operationalize the principles of UDI to provide concrete constructs that can be "applied" to specific activities and thus evaluated as to

effectiveness.

- Apply the operationalized principles of UDI in intervention studies to investigate the impact on objective student outcome measures.
- Continue to investigate the use of UDI in postsecondary educational settings to determine where and how it is effective in improving student outcomes. This is particularly important as more ways of transferring knowledge (i.e., educating our students) become available (e.g., emerging technologies).

Conclusion

Universal Design for Instruction is an exciting conceptual approach that appears theoretically sound but lacks a substantial empirical research base. Development of a more extensive research base on the use of UDI in postsecondary educational settings, which moves beyond initial concerns regarding definition and theory to intervention research that examines the impact of UDI on objective measures of student outcomes, is needed. Through this type of research, the effectiveness of UDI for improving outcomes for postsecondary students, including those with disabilities, will be determined, and advocacy efforts for applying UDI will be fully justified.

References

Americans with Disabilities Act (ADA) of 1990, Pub. L. No. 101-336, 104 Stat. 327 (1990).

Architectural Barriers Act of 1968, Pub. L. No. 90-480, 82 Stat. 718 (1968).

Center for Applied Special Technology (2008). Universal design for learning guidelines version 1.0. Wakefield, MA: Center for Applied Special Technology. Retrieved from http://www.cast.org/publications/UDLguidelines/version1.html

The Chronicle of Higher Education. (2008). Almanac, 2008-9, 1, 3-35.

Connell, B. R., Jones, M., Mace, R., Mueller, J., Mullick, A., Ostroff, E., . . .Vanderheiden, G. (1997). *Principles of universal design. Version 2.0.* Raleigh, NC: North Carolina State University. Retrieved from http://www.design.ncsu.edu/cud/about_ud/udprinciplesshtmlformat.html#top

Education of the Handicapped Act of 1975, Pub. L. No. 94-142, 89 Stat. 773 (1975).

Embry, P., Parker, D., McGuire, J., & Scott, S. (2005). Postsecondary disability service providers' perceptions about implementing universal design for instruction. *Journal of Postsecondary Education and Disability, 18*(1), 3-48.

Harper, K. A., & DeWaters, J. (2008). A quest for website accessibility in higher education institutions. *Internet & Higher Education, 11*(3/4), 160-164. doi: 10.1016/j.iheduc.2008.06.007

Higher Education Opportunity Act of 2008, Pub. L. No. 110-315, 122 Stat. 3078 (2008).

Individuals with Disabilities Education Improvement Act of 2004, Pub. L. No. 108-446, 118 Stat. 2647 (2004).

Institute for Human Centered Design (2008). *History of universal design*. Retrieved from http://www.adaptiveenvironments.org/index.php?option=Content&Itemid=26#

Izzo, M. V., Murray, A., & Novak, J. (2008). The faculty perspective on universal design for learning. *Journal of Postsecondary Education and Disability, 21*(2), 60-72.

Koch, L., Hennessey, L., Ingram, A., Rumrill, P., & Roessler, R. (2006). Faculty learning communities to promote full inclusion of SWDs on college and university campuses. *Rehabilitation Education, 20*, 191-200.

McGuire, J., & Scott, S. (2006). An approach to inclusive college environments: Universal design for instruction. *Learning Disabilities: A Multidisciplinary Journal, 14*, 21-31.

McGuire-Schwartz, M. E., & Arndt, J. S. (2007). Transforming universal design for learning in early childhood teacher education from college classroom to early childhood classroom. *Journal of Early Childhood Teacher Education, 28*(2), 127-139.

Newby, W. (2005). Voices from the classroom. *Publications of the Modern Language Association of America, 120*, 598-602.

Ofiesh, N. S., & McAfee, J. A. (Eds.). (2006). Universal design in higher education [Special issue]. *Journal of Postsecondary Education and Disability, 19*(2).

Parker, D. R., Robinson, L. E., & Hannafin, R. D. (2007-2008, Winter). "Blending" technology and effective pedagogy in a core course for preservice teachers. *Journal of Computing in Teacher Education, 24*(2), 61-66.

Rehabilitation Act of 1973, Pub. L. No. 93-112, 87 Stat. 335 (1973).

Rickerson, N., & Deitz, J. (2003). Integration of universal design of instruction in occupational therapy professional education: Responding to student diversity. *The American Journal of Occupational Therapy, 57*, 594-597.

Shaw, S. F., Scott, S. S., & McGuire, J. M. (2001). Teaching college students with learning disabilities. *ERIC Digest*. Retrieved from http://www.ericdigests.org/2002-3/college.htm

Scott, S., McGuire, J., & Shaw, S. (2003). Universal design for instruction: A new paradigm for adult instruction in postsecondary education. *Remedial and Special Education, 24*, 369-379.

Spooner, F., Baker, J. N., Harris, A. A., Ahlgrim-Delzell, L., & Browder, D. M. (2007). Effects of training in universal design for learning on lesson plan development. *Remedial and Special Education, 28*(2), 108-116. doi: 10.1177/07419325070280020101

Zhang, Y. (2005). A collaborative professional development model: Focusing on universal design for technology utilization. *ERS Spectrum, 23*(3), 32-38.

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