

Universal Design: A Problem-Based Exercise in a Fast-Paced Competitive Environment

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Abstract

Universal Design (UD) involves the creation of accessible, flexible products that are functional for a wide population of users. Our problem-based learning exercise challenges student teams to create products and services guided by the principles of UD. After teams generate their new product concept, a spokesperson from each team pitches it in front of the class. Using polling software, the entire class evaluates the student-generated solutions on two criteria: the integration of UD principles and creativity. This fast-paced, gamified activity is scalable from small classes to large-class populations (of 100 students) or online settings. Our goal is to help all participants understand the benefits of inclusiveness in the creative design process.

Keywords

entrepreneurship, universal design, product design, disabilities, experiential, game-exercise, creativity, problem-based learning

Universal Design (UD) is an approach to designing products, services, and work environments that are useful and functional for as wide a population as possible, including people with disabilities (McGuire et al., 2006). A common misperception of UD is that

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it benefits only a small segment of older and disabled individuals (National Disability Authority, 2017). Instead, UD aims to emphasize a problem-based learning approach for creating products and services that can be “functional for the greatest number of users” (Welch & Palames, 1995, p. iii). Furthermore, the process of UD recognizes that almost all individuals may encounter physical, emotional, or behavioral disabilities at some point in their life (National Disability Authority, 2017).

The appreciation for disability and renewed debate for inclusion have generated opportunities in a market-driven economy. There are an estimated 1.85 billion people with disabilities worldwide, generating over \$1.9 trillion in annual disposable income (Return on Disability, 2021). Products inspired by a disability-related need, like Oxo’s Good Grips utensils, are often popular with people who do not have disabilities. Given the size of this consumer market, there is a surprising lack of emphasis on inclusive features in the design of business models and the delivery of new products and services.

We use a problem-based learning activity to raise awareness of the principles of UD, integrate theory and practice, and apply knowledge to develop viable solutions to real-world challenges. The exercise is appropriate for introductory, upper level, and graduate courses in entrepreneurship and management and has been used with both undergraduate and graduate students who will be working with or designing products and services for diverse populations. This experiential, learner-centered approach fosters inclusion and sensitivity to disability-related problems.

Theoretical Foundation

This activity focuses on creativity in collaborative teams, problem-based learning, and intergroup competition to promote problem solving and innovation. The need for creativity and ingenuity to solve a myriad of problems has never been greater. Creativity often focuses on the individual’s contribution to solving a problem; this is the myth of the “lone genius.” Although individual contributions to solving problems or discovery should not be dismissed, Paulus and Nijstad (2003) advance the need to promote Big-C creativity, which Gardner (1993) defines as something generating a profound impact on society as compared with everyday or little-c creativity. Big-C creativity is especially salient to innovations that reflect an understanding of the problems confronting people with disabilities.

Problem-based learning has been used successfully for over 30 years across disciplines as a learner-centered approach that fosters integration and application of new concepts. Savery (2015) points out that critical to the success of the method are the selection of interdisciplinary problems and a facilitator who guides the learning process and conducts a thorough debriefing after the learning experience. The UD activity outlined here allows the students to engage collaboratively in identifying solutions and compete with other student teams. The judging of ideas based on the creativity and integration of the UD principles offers a unique mechanism for intragroup cooperation in an experiential learning exercise.

Table 1. Materials Needed for Universal Design Exercise.

Materials needed	Found in	For use in
Seven Principles of Universal Design	Figure 1	Preparation for activity
Pitch Ranking Sheet	Appendix A	Preparation for activity
Sample Challenge	Appendix B	Activity
Competitive Challenges	Appendix C	Activity
Notes on Inclusion	Appendix D	Optional
Information about Specific Disabilities	Appendix E	Synchronous online session
Instructions for Online Session	Appendix F	Optional
Debriefing Questions	Appendix G	Debriefing
Slideshow on Universal Design	Supplemental material	Activity

The design of the activity is based on the finding that intergroup competition promotes intragroup cooperation in both laboratory and applied settings (Bornstein & Erev, 1994). We create small student teams that compete with each other in a low-stakes, game-styled exercise. Research supports the benefits of gamification on learning outcomes (Dempsey et al., 1994; Kapp, 2012).

Learning Objectives

By engaging in this activity, students will

1. Become aware of and explain problems confronting people with disabilities
2. Work collaboratively in groups by applying problem-based learning techniques to generate solutions
3. Apply the principles of UD in the creation of new products and services
4. Judge the merit of new product concepts using UD criteria

Instructions for the Exercise

Activity Overview

This problem-based learning exercise introduces the Seven Principles of UD (Connell et al., 1997) and conveys the value of considering diverse consumers in the design process. Students review the Seven Principles and then work in teams to develop universally designed products that address specific challenges. Team leaders pitch their solutions in a game-style competition, and the class votes on the best design. The activity can be implemented with small discussion classes or large lecture classes and runs between 45 and 75 minutes, depending on class size. All materials needed for the activity, along with the relevant appendices, are listed in Table 1.

Pre-Activity Preparation (30 Minutes)

1. Given your class size, determine the number of challenges and teams you will need in advance. This activity operates ideally with three to five students on a team. Small classes of under 20 students may have four to five teams in a pitch competition using one UD challenge. The activity is scalable by increasing the number of UD challenges. For example, in a class of 100 students, we use five different UD challenges. For each challenge, five teams of four students each compete.
2. Print the Seven Principles of UD (Figure 1; adapted from the Center for Universal Design, NC State, 2011), and include the Pitch Ranking Sheet on the back (Appendix A). They are also available as supplemental materials.
3. Print the Sample Challenge (Appendix B) and note that Appendix C offers some insights on how to create your own UD challenges.
4. Print the Competitive Challenges (Appendix C). For example, with a class of nine teams, print three copies each of Challenge A, Challenge B, and Challenge C, respectively. They are available as handouts as supplemental materials.
5. Download the slide show to introduce Universal Design (the slides are available as supplemental materials).
6. Select the polling software (e.g., Polleverywhere,¹ Kahoot,² Slido³) that you want to use to allow students to vote for the best pitch for each competitive challenge. Modify the slides so that you can poll students after each competitive challenge (i.e., after Challenge A, Challenge B, and Challenge C).
7. We note that most instructors will have students with disabilities in their courses at some point. We suggest that instructors review the *Notes on Inclusion* provided in Appendix D for suggestions on how and why to create inclusive classroom communities. In addition, if you think your students might benefit from background information about the specific disabilities mentioned in the Competitive Challenges, please refer them to the links provided in Appendix E.

Activity Stage 1: Sample Challenge (10-15 Minutes)

This exercise can be conducted both in face-to-face classrooms and online. The instructions below are for in-person execution. For details about executing an online session, please see Appendix F.

1. Distribute to each student in the room the Seven Principles of UD with the Pitch Ranking sheet on the reverse side.
2. Start the class by telling the students that they will be playing a game that illustrates the Principles of UD.

Equitable Use

The design is useful and marketable to people of diverse abilities and needs.



Automatic doors are useful to people with strollers, shopping carts, wheelchairs, and packages.

Tolerance for Error

The design minimizes hazards and adverse consequences of unintended or accidental actions.



The UNDO button allows for easy correction of computer errors.

Flexibility Use

The design accommodates a wide range of individual preferences and abilities.



Large-grip scissors accommodate use with either hand and allow alternation between the two in highly repetitive tasks.

Simple and Intuitive

The use of the design is easy to understand, regardless of one's experience, language skills or education level.



Emergency phones on campus are painted in standard colors and have easy-access, one-push buttons for summoning help.

Size and Space

Appropriate size and space are provided for approach, use, and manipulation regardless of a person's size, position, or mobility.



Wide gates accommodate people in wheelchairs as well as those with packages or strollers.

Perceptible Information

The design communicates necessary information effectively to the user regardless of ambient conditions or the user's sensory abilities.



Universally-designed crosswalks include both visual and auditory signals.

Low Physical Effort

The design can be used efficiently and comfortably with a minimum of fatigue.



Door levers do not require grip strength to operate and can even be used with an elbow.

Figure 1. Principles of Universal Design. Note. Adapted from Center for Universal Design, NC State (2011) based on the Seven Principles of Universal Design (Connell et al., 1997).

3. Show the YouTube presentation linked on Slide 1 of the slideshow (https://www.youtube.com/watch?v=b4lw6K61uHo&feature=emb_logo).
4. Review each principle of UD on Slide 2.
5. Put the students into teams.
6. Share the Sample Challenge on Slide 3 with the class. Have students work with their teams to discuss potential solutions to the Sample Challenge for 3 minutes.
7. Then randomly select a few students who are willing to share their team's ideas. Be clear on the expectations for students:
 - Name of product or service that you would create.
 - How will it use UD to address the challenge you were given?
 - How and why will it be of appeal to a universal audience, beyond disability?
8. After a few students share ideas about the Sample Challenge, provide feedback on how to improve their idea generation.

Activity Stage 2: UD Team Challenges (20-30 Minutes)

1. Ask each team to send a representative to the front of the room to collect a Competitive Challenge card. Using Slide 4, review the team instructions printed on the Competitive Challenge card with the class. Each team selects a spokesperson, who will later present the team's solution to the class. Before students develop their solutions, explain the Pitch Ranking sheet on Slide 5 so that students understand the ranking criteria and process.
2. Each team has 10 minutes to review their assigned challenge and create a product or service that solves this challenge based on the principles of UD. The team spokesperson will have just 30 seconds to pitch their solution. Remind the teams that the winning team for each challenge will be selected by a class vote.
3. After the 10 minutes, the spokesperson for each team assigned Competitive Challenge A comes to the front of the room with their notes/answers on their challenge card handout. Each team is assigned a team number and teams present in numerical order. As a tip, we recommend that you remind each spokesperson of their assigned team number and ask them to restate their team number to the entire class at the start of their pitch (to help with the voting).
4. Proceeding to Slide 6, read Competitive Challenge A to the whole class (as nonpresenting teams will have different challenges).
5. Each team spokesperson has 30 seconds to present their new product concepts. It may be helpful to appoint a student volunteer as time-keeper to maintain pace. After each pitch, students use the Pitch Ranking Sheet to score each idea. After all pitches for Challenge A are complete, the class votes for the best idea

for Challenge A using polling software. Teams that competed in Challenge A should rate themselves and can vote. The facilitator announces the winner for Challenge A.

6. Depending on class size, the exercise with Challenges B and C.

Debriefing After the Exercise (10-25 Minutes Depending on the Time Available)

As part of the debriefing, have students reflect on what they learned from this exercise. Ask the following questions:

1. What did you learn about disability?
2. What were the benefits and challenges to group work?
3. What did you learn about UD?
4. Give some examples of ways in which the proposed solutions utilized UD.
5. How will you apply UD in the future?
6. What did you enjoy the most?

Points for potential follow-up discussion are included in Appendix G.

Conclusion

A core element of the activity is the education of business students about the genuine value that individuals with disabilities bring to the workplace and their value as customers. This exercise elevates students' comfort and competence in designing for, and collaborating with, individuals with disabilities by introducing the principles of UD in a way that fosters application through collaborative teaming and problem solving. UD encourages the creation of products and services that are maximally useful and adaptive for a large number of consumers, thus increasing marketability and profitability. The activities involved here harness the pedagogical power of problem-based learning, intragroup cooperation, and low-stakes competitive gaming (Bornstein & Erev, 1994; Kapp, 2012; Savery, 2015). While the product concepts are designed to be applicable and accessible to as many people as possible, we place particular emphasis on the inclusion of individuals with intellectual and developmental disabilities.

We have found that the use of polling software saves valuable time and helps create a game atmosphere that makes the learning environment more engaging with our student population. Finally, we found in earlier renditions of the exercise that some teams won due to the humor and extraversion of the spokesperson rather than the merit of their pitch. Therefore, when students vote on the best idea for each challenge problem, we recommend that facilitators emphasize the criteria on the Pitch Ranking Sheet, including the application of UD principle(s) and creativity of the solutions.

Appendix A

Pitch Ranking Sheet

Instructions: Each team will present their idea for 30 seconds. Your job is to rate each idea immediately after it is presented and then tally the scores to determine who wins each challenge. Rate each idea on the following two dimensions:

1. APPLICATION OF UD: On a scale of 1 to 5, how well did the idea utilize the principles of UD to solve the challenge?
2. CREATIVITY AND UNIVERSAL APPEAL: On a scale of 1 to 5, how creative is this idea, and do you believe this product or service appeals to a broad audience?

EXAMPLE	Team 1	Team 2	Team 3	Team 4
Application of UD (up to 5 points)	<u> 4 </u>	<u> 3 </u>	<u> 3 </u>	<u> 2 </u>
+				
Universal Appeal (up to 5 points)	<u> 2 </u>	<u> 5 </u>	<u> 4 </u>	<u> 1 </u>
Total Score	<u> 6 </u>	<u> 8 </u>	<u> 7 </u>	<u> 3 </u>

WINNER WOULD BE TEAM 2, WITH A HIGH SCORE OF 8.

CHALLENGE A	Team 1	Team 2	Team 3	Team 4
Application of UD (up to 5 points)	<u> </u>	<u> </u>	<u> </u>	<u> </u>
+				
Universal Appeal (up to 5 points)	<u> </u>	<u> </u>	<u> </u>	<u> </u>
Total Score	<u> </u>	<u> </u>	<u> </u>	<u> </u>

CHALLENGE B	Team 1	Team 2	Team 3	Team 4
Application of UD (up to 5 points)	<u> </u>	<u> </u>	<u> </u>	<u> </u>
+				
Universal Appeal (up to 5 points)	<u> </u>	<u> </u>	<u> </u>	<u> </u>
Total Score	<u> </u>	<u> </u>	<u> </u>	<u> </u>

CHALLENGE C	Team 1	Team 2	Team 3	Team 4
Application of UD (up to 5 points)	<u> </u>	<u> </u>	<u> </u>	<u> </u>
+				
Universal Appeal (up to 5 points)	<u> </u>	<u> </u>	<u> </u>	<u> </u>
Total Score	<u> </u>	<u> </u>	<u> </u>	<u> </u>

Appendix B

Sample Challenge, Questions, and Instructions for Team Representatives

We have provided a sample challenge here along with questions and instructions for the team representative that may be used in the competitive challenges.

Allie is a single mother of two children and an architect. A recent illness caused her to lose her peripheral vision on her right side, creating challenges for her when driving. Allie needs to maintain her driving ability so that she can get to work, get her kids to school and activities, and run the errands necessary for her household.

Your solution?

How will this help other people in other ways?

Team representative instructions. Provide the following information to the class. We have suggested the time you should allot for each item.

1. Your Group # as assigned by instructor (3 seconds):
2. Name of product or service that you would create (3 seconds):
3. How will it address the challenge you were given (10 seconds)?
4. How and why will it be of appeal to a universal audience, beyond disability? Be sure to explain how this product/service goes beyond options already available on the market and is more than a simple app (14 seconds).

Appendix C

Competitive Challenges

This appendix provides three examples of competitive challenges. Of course, instructors may choose to develop their own challenges. In developing alternatives, we recommend that they be 75 words or less, be open-ended with multiple solutions, and feature a disability that students can relate to and understand. In the handouts, each challenge includes questions and instructions for the team representative.

Challenge A. Julisa was recently diagnosed with Alzheimer's disease. She has some difficulty with memory and gets lost even in familiar surroundings. Her husband of 50 years wants to take care of her at home and cannot afford help. The problem is that Julisa has a tendency to leave the house and wander when her husband isn't looking. She will not carry a phone. Her husband is afraid he won't be able to find her and that she will get hurt.

Challenge B. Kayla is a sophomore with Down syndrome enrolled in college classes. In her first year, Kayla benefited from the personal relationships she developed with her peers and with faculty. These relationships enhanced her interpersonal skills, fostered academic progress, and increased her connections for employment. Kayla is

concerned about her ability to cultivate these relationships if she takes some classes online.

Challenge C. Jason is a young adult with autism who lives on his own, has a job, and can drive. In most ways, he is independent. However, he has difficulty with complex decisions, like what cell phone plan to use or which car insurance to buy. Especially difficult are decisions that involve multiple options that cannot be compared directly (e.g., unlimited data use for \$100 vs. a free new phone every year).

Appendix D

Notes About Inclusion

We wanted to share some general notes on inclusion so that people with or without disabilities understand why this activity is essential to promoting inclusivity for all.

Disability is not always visible. Please do not make any assumptions about others: We have been fortunate to have facilitators/authors who had disabilities and/or were parents of children with disabilities (Down syndrome, autism spectrum disorder). Furthermore, our institution offers a 4-year, fully inclusive certificate program for students with mild intellectual and/or developmental disabilities who were part of the class year after year. Finally, like so many institutions around the country, we had many students with extended military service dealing with significant learning disabilities. You will have people with a disability in your course. Show empathy and understanding and emphasize the importance of the journey toward understanding.

Acknowledge, understand, and embrace the widespread nature of disability: We have learned the importance of prefacing this activity by emphasizing that society needs to be inclusive of all. Disability touches every demographic (gender, age, race, sexual orientation, etc.) and impacts most people eventually through birth, accident, illness, or aging. People with disabilities comprise the largest minority group in America. Sixty-one million Americans have a disability, so we emphasize that it is not a problem but an opportunity.⁴ As a consequence of this class exercise, people with disabilities have shared their journeys with classmates and with activity facilitators.

Use appropriate language and etiquette: Each time this activity runs, we have had to educate students about the power of words. We encourage you to avoid language with negative connotations about disability and to ask students to do the same. Offering ways to rephrase their thoughts about disability can be useful.

1. Refer to people respectfully: Encourage the use of “people-first language.”

Example 1

- Anita might say: “Disabled folks need better doors.”
- Rephrase: “People with a disability should be able to open all doors regardless of their disability.”

Example 2

- Jacob might say: “Down syndrome people make good greeters.”
 - Rephrase: “People with Down syndrome should be offered training and opportunity for a wide variety of jobs.”
2. Use the word “disability”: Discourage the use of words like special needs, retarded, and so on.

Students should be encouraged and reminded to change their language, but some flexibility should be allowed during the exercise as the changes will be new for some students and thus difficult to implement immediately. We have found that positive reminders are more effective than negative penalties in this endeavor.

Appendix E

Background Information on Disability

For a brief overview of background information that students might find useful in addressing the competitive challenges, please see the links below.

- Alzheimer’s disease: <https://tinyurl.com/yyfna5qw>
- Down syndrome: <https://www.ndss.org/about-down-syndrome/down-syndrome/>
- Autism: <https://www.nimh.nih.gov/health/topics/autism-spectrum-disorders-asd/index.shtml>

Appendix F

Instructions for Running the Activity in a Synchronous Online Class

The COVID-19 crisis offered a unique opportunity for the instructors to teach this lesson using software for online meetings. The use of chat rooms specifically allowed the instructors to use this activity in synchronized online settings. We recommend that facilitators follow the above instructions with the following variations.

Pre-Activity. Send out the Seven Principles of Universal Design, the Pitch Ranking Sheet, the Sample Challenge, and all three Competitive Challenges to the entire class ahead of time and ask the students to print them. Repost both the Pitch Ranking Sheet and the Competitive Challenges using the chat window in your online meeting platform.

Activity. Explain to participants that they will be assigned breakout rooms, and be sure to practice using the breakout rooms in advance. Before launching the breakout rooms, remind all participants that you will visit randomly with groups (this helps keep them engaged) and that a counter will let them know when they have 1 minute left to come

back to the entire group to make their 30-second pitches. Use your meeting platform to automatically assign attendees to breakout rooms. Select the number of rooms you desire and start the breakout rooms. Assign Challenge A to one third of the breakout rooms, and so on, respectively, with Challenges B and C.

Allow groups 10 minutes to brainstorm ideas. Once the time has expired, it is helpful to remind the students to use the Pitch Ranking sheet after each team presentation. You can opt to use the polling option available in your online platform, or use an external polling software to have students vote. If you choose the latter, be sure to remind students to have a cellphone available to use the external polling software.

Debriefing. The chat window can capture people's reactions to the activity; the chat content is downloadable after each recorded session (if you elected to record it).

Appendix G

Suggestions for Debriefing

When students have completed the exercise, engage in a focused discussion using the questions below, with the goal of determining whether the learning objectives have been met.

1. *What did you learn about disability?* The first learning objective is that students become aware of and explain the problems confronting people with disabilities. Many students acknowledge that prior to the exercise they never considered disability an important factor in product design. Some will indicate that they didn't recognize that disability affected such a large number of people. Be sure students can generate and explain different types of challenges (e.g., physical, sensory, intellectual, psychological) that people with disabilities confront.
2. *What were the benefits and challenges to group work?* A second learning objective is that students learn to collaborate with teammates to generate solutions to problems. Ask students to consider their own contributions to the solutions and their interactions with classmates. Then have them suggest ways to improve their interactions in the group.
3. *What did you learn about universal design?* Students often report how easy it is to incorporate the universal principles into the design phase and the advantage it offers in terms of marketability and profit. As a follow-up, consider polling students about changes in their comfort level regarding issues related to disability. Many students report greater comfort and confidence in their ability to develop products for people with disabilities.
4. *Give some examples of ways in which the proposed solutions utilized universal design.* A fourth learning objective is the ability to judge the merit of a new product using UD criteria. Students should be able to explain the ways in which the solutions generated during the exercise utilized UD to solve the

challenges. It can be helpful to remind students of the seven principles of UD and to point out the solutions that were especially creative or successful in applying those principles.

5. *How will you apply UD in the future?* Some students are initially hesitant about applying UD principles as part of a business course. However, through this exercise students recognize that UD enhances the value and appeal of a product for everyone and is far more cost effective if implemented at the start relative to adapting a product later.
6. *What did you enjoy the most?* The majority of our students report enjoying the fast-paced, gaming nature of the activity. As a follow up, ask students to reflect on how the competitive nature of the exercise affected their team interactions. Many of our students report higher investment and engagement as a result of the competition.

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Supplemental Material

Supplemental material is available at <http://journals.sagepub.com/doi/suppl/10.1177/2379298121995177>

Notes

1. Poll Everywhere is a product and trademark of Poll Everywhere, Inc. (<https://www.poll-everywhere.com/>).
2. Kahoot! is a product and trademark of Kahoot! AS (kahoot.it).
3. Slido is a product and trademark of Slido s.r.o. (sli.do).
4. Centers for Disease Control and Prevention. (2019, March 8). *Disability impacts all of us infographic*. <https://www.cdc.gov/ncbddd/disabilityandhealth/infographic-disability-impacts-all.html>

References

- Bornstein, G., & Erev, I. (1994). The enhancing effect of intergroup competition on group performance. *International Journal of Conflict Management*, 5(3), 271-283. <https://doi.org/10.1108/eb022747>
- Center for Universal Design, NC State. (2011). *7 Principles of universal design*. Interaction Design Foundation. <https://www.interaction-design.org/literature/article/learn-to-create-accessible-websites-with-the-principles-of-universal-design>
- Connell, B. R., Jones, M., Mace, R., Mueller, J., Mullick, A., Ostroff, E., Sanford, J., Steinfeld, E., Story, M., & Vanderheiden, G. (1997). *Principles of universal design*. North Carolina State University, Center for Universal Design. https://projects.ncsu.edu/ncsu/design/cud/about_ud/udprinciplestext.htm
- Dempsey, J. V., Rasmussen, K., & Lucassen, B. (1994, February). *Instructional gaming: Implications for instructional technology* [Paper presentation]. Paper presented at the annual meeting of the Association for Educational Communications and Technology, Nashville, TN, United States. <https://files.eric.ed.gov/fulltext/ED368345.pdf>
- Gardner, H. (1993). *Creating minds*. BasicBooks.
- Kapp, K. M. (2012). *The gamification of learning and instruction: Game-based methods and strategies for training and education*. John Wiley.
- McGuire, J. M., Scott, S. S., & Shaw, S. F. (2006). Universal design and its applications in educational environments. *Remedial and Special Education*, 27(3), 166-175. <https://doi.org/10.1177/07419325060270030501>
- National Disability Authority. (2017). *10 Things to know about UD*. <http://universaldesign.ie/What-is-Universal-Design/The-10-things-to-know-about-UD/>
- Paulus, P. B., & Nijstad, B. A. (2003). *Group creativity: An introduction*. Oxford University Press.
- Return on Disability. (2021). <https://rod-group.com/insights>
- Savery, J. R. (2015). Overview of problem-based learning: Definitions and distinctions. In A. Walker, H. Leary, C. E. Hmelo-Silver, & P. A. Ertmer (Eds.), *Essential readings in problem-based learning: Exploring and extending the legacy of Howard S. Barrows* (pp. 5-16). Purdue University Press.
- Welch, P., & Palames, C. (1995). *A brief history of disability rights legislation in the United States. Strategies for teaching universal design*. Adaptive Environments Center.