Increased Accessibility for People With Visual Impairments in an Online Learning Environment

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ABSTRACT
Online education has proliferated over the past several decades and is continuing to grow (Decelle, 2016). Teaching online has taken educators outside of their comfort zones and has provided unique opportunities to promote student success in an online learning environment (Archibald, 2017). To encourage accessibility for all students, including people with visual impairments and other disabilities, online educators need to have an increased understanding of how universal design for learning serves as a framework to support inclusion (Campbell et al., 2016). The purpose of this article is to educate occupational therapy practitioners and educators who teach online about how to design online courses and presentations that are accessible for people with visual impairments.

LEARNING OBJECTIVES
After reading this article, you should be able to:
1. Describe the effect of common visual impairments on a person's participation in online education
2. Recognize the importance of creating an online classroom that is accessible for all students
3. Identify simple universal design strategies that can be applied to promote accessibility in an online classroom
4. Discuss the role of occupational therapy in modifying online classrooms for improved accessibility

INTRODUCTION TO ACCESSIBILITY IN AN ONLINE LEARNING ENVIRONMENT
Online education has progressed from its beginnings as a basic discussion board to currently include virtual classrooms and simulations (Smith Glasgow et al., 2017). Ghilay (2017) argued that online learning exceeds traditional instruction in many empowering ways, including improving student interest and engagement. Additionally, Ghilay (2017) explained that engaged learners have improved motivation, which is reflected in the quality of learning.

The Americans with Disabilities Act (ADA) was signed into law on July 26, 1990, and prohibits discrimination against a person with a disability in employment, public services, and public legislation that would restrict the ability of that person to enforce their right to access public accommodations (Page, 2018). Given the necessity of accessing online services in today’s world, people with disabilities are continuing to turn to the ADA to guide them in breaking down barriers (Girma, 2015).

BACKGROUND
In a virtual environment, communication occurs by means of airwaves or computers and in the absence of physical contact, including real-time or near-time environments (American Occupational Therapy Association, 2014). Virtual, or online, education has proliferated over the past several decades and is continuing to grow (Decelle, 2016). Teaching online has taken
educators outside of their comfort zones and has provided unique opportunities to promote student success in an online learning environment (Archibald, 2017). To promote accessibility for all students, including students with visual impairments and other disabilities, online educators need to have an increased understanding of how universal design for learning (UDL) serves as a framework to support inclusion (Campbell et al., 2016).

The virtual context or environment encompasses more than online classrooms in higher education. Hanft and Shepherd (2016) described the virtual context as including a school’s information and technology networks. The virtual context has become prominent in education settings and is essential for improving the performance of students with and without disabilities. As an example, many classrooms are equipped with interactive whiteboards connected to computers and computer projection systems to support virtual assignments and lessons—additionally, school intranet and teacher homepages provide homework, upcoming class activities, and newsletters.

EDUCATION IN AN ONLINE CLASSROOM

Williams (2017) explained that faculty in postsecondary settings are encountering new obstacles in response to increased requests for accommodations and an increased need to adopt inclusive teaching practices. Simmons and colleagues (2010) found that higher education professionals are challenged to design courses to effectively reach the growing diversity of students, including students with disabilities. Fichten and colleagues (2009) argued that there is a clear need for training that is responsive to students’ needs for accessible electronic learning materials and that improvements made through universal instructional design will result in increased accessibility.

Patel (2014) noted that education professionals must ensure that students are not limited by pedagogy. Because of the asynchronous nature of communication in the online learning environment, however, it can be difficult for online teachers to determine whether each student is fully participating in the class. Therefore, it is imperative for online educators to ensure that each student can access an equitable educational experience. According to Burgstahler (2017), Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 establish a firm legal basis that information technology procured, developed, and used by postsecondary institutions be accessible to individuals with disabilities. The author noted that together these statutes require that all campus offerings (including Web-based courses) be available to all students, faculty, staff, and visitors for whom they are designed, including individuals with disabilities.

EFFECT OF A VISUAL IMPAIRMENT OR DISABILITY ON STUDENT LEARNING

According to Chan and colleagues (2018), low vision and blindness are leading causes of disability (loss of functional ability) among U.S. residents. Varma and colleagues (2016) noted that in 2015, up to 8.2 million people were affected by an uncorrected (not corrected with glasses or contact lenses) visual impairment. Functional ability is defined as the ability to engage in occupations (Liu, 2018). Romney and Celeste (2015) found evidence-based practice requires that the design of digital learning resources respect diverse ways of learning, to include accessibility. Umeda et al. (2017) found that implementation of the Americans with Disabilities Act (ADA) standards have yet not fully addressed hidden access and participation barriers.

Visual impairment can be defined as a loss or abnormality of visual function, whether physiological or psychological. Examples of visual impairments include loss of visual acuity, reduced contrast sensitivity, and constricted visual field. Visual disability is considered a restriction or inability to perform a task in a manner that is regarded as typical. Loss of function for a student with a visual impairment or disability may affect the person’s ability to read or recognize objects (Whittaker et al., 2016).

Butler (2016) described some interventions to assist with visual impairment issues that are within the scope of occupational therapy, such as increasing contrast between objects and their backgrounds to improve visual function. As discussed by Whittaker and colleagues (2016), not everyone can read fluently with magnification alone. Other factors, such as print contrast, must be considered as well.

Common Visual Impairments That Affect Functioning in an Online Classroom

Decreased Visual Acuity: Reduced ability to see small, high-contrast objects

- Difficulty reading
- Difficulty seeing images on television (or computer monitor)

Decreased Contrast Sensitivity: Reduced ability to see larger, low-contrast objects

- Difficulty seeing faded print or print on colored background

Visual Field Loss: Loss of vision where the person is trying to look

- Difficulty finding place when scanning
- Misses words and letters

Impaired Oculomotor Functioning: Difficulty controlling eye movements

- Double vision or blurred vision

(Whittaker et al., 2016)

TECHNOLOGY AND LEARNING

Howard (2002) suggested that Web-based courses present unique problems for student engagement and that instructors need to consider how the mode of delivery affects the level and quality of student participation and student learning. According to Goode (2010), technology is central to the daily routine of campus life, and computers have become a symbol of access to a rigorous curriculum. However, students come to college with varied computing history, which affects their relationship with the technology needed to pursue their academic aspirations.
Accessibility in an Online Classroom

Accessibility in an online learning environment may include creating universal accommodations in the classroom. Pogrund (2018) defined accommodations as supports and services that change how an individual learns. Kaiser and Herzberg (2017) suggested that students with visual impairments are each unique in how their visual impairment affects their functioning in educational settings.

McDowell and Budd (2018) found that a learning environment is more effective when care is taken regarding the placement of materials and using spaces. The authors suggested that classroom clutter can be visually distracting and interrupt learning for people with visual impairment. The concept of placement of materials is applicable in the physical and virtual classroom. McLaughlin and Kamei-Hannan (2018) demonstrated support for accessibility for visually impaired learners by explaining that if a student must concentrate on simply decoding reading material, the student’s ability to gather meaning from the text is limited.

According to Taylor (2017), the role of occupational therapy practitioners using the Model of Human Occupation (MOHO) can include creating environments that support a person’s performance capacity, skills, participation, and occupational adaptation. The occupational role of being a student may be affected by barriers in the environment that limit access to the course or course content. The occupational performance of a student may be optimized by addressing constraints that affect occupational functioning in the context of the school environment.

UNIVERSAL DESIGN FOR LEARNING

Oswald and colleagues (2018) found the shift to online and hybrid style courses offers many benefits for students and educators, but it also comes at a cost for some students, who live with various levels of sensory impairment. Students with disabilities (visual or otherwise) often face additional obstacles in online learning when attempting to access electronically delivered content. Such barriers include spending excessive amounts of time navigating course content and assignments, being unable to access certain content, and waiting on materials to be converted into accessible formats.

Knarlag and Olaussen (2016) described UDL as fostering educational practice that offers variation and flexibility in the way that information is presented. The authors explained that the application of UDL strategies affects the way that students respond, demonstrate skills, and engage in their learning process. Oswald and colleagues (2018) explained that the purpose of universal design in an educational setting is to create an equally accessible learning environment for students of varying abilities.

Hall and colleagues (2012) stated that UDL is a framework for instruction organized around three principles that are based on the learning sciences. This framework provides flexibility in the ways information is presented, how students demonstrate knowledge and skills, and how students are engaged.

**Principle 1:** Provide multiple means of representation. Representation is the “what” of learning. Offer multiple ways to present what we teach and learn.

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**Figure 1. Universal Design for Learning’s Connection to Representation, Action and Expression, and Engagement**
Principle 2: Provide multiple means of action and expression. Action and expression are the “how” of learning. Offer flexible options for how students learn and express what they know.

Principle 3: Provide multiple means of engagement. Engagement is the “why” of learning. Offer flexible options for generating and sustaining motivation (see Figure 1 on p. CE-3).

Universally designed curriculum and learning environments provide students with multiple ways of viewing or listening to information (representation), expression, and engagement. UDL principles can be applied to overall course design as well as to specific instructional materials, such as lectures, learning activities, group work, handouts, labs, and online instruction. The principles of UDL recognize that variance across individuals is the norm, not the exception, and curriculum should be adaptable to individual differences rather than the other way around (Hall et al., 2012).

Hall and colleagues (2012) explained that U.S. colleges and universities must comply with the ADA and other pertinent policies. The Higher Education Opportunity Act of 2008 includes a definition of UDL, which emphasizes reducing barriers in instruction and providing appropriate supports while maintaining high achievement expectations for all students. UDL principles may be applied for compliance with laws about accessibility while also promoting active learning for all students (Hall et al., 2012).

Simple Universal Design Strategies for a Virtual Environment

- Reduce visual clutter (such as patterns, unnecessary graphics, emojis).
- Large print type should be used. Preferably 18 point, but 16 point at a minimum.
- Avoid decorative fonts.
- Use bold type because the thickness of the letters makes the print more legible. Dark type on a light background maximizes contrast.
- Avoid using italics or all capital letters. Both forms of print make differentiating among letters more difficult.
- When appropriate, allow flexible time limits for students to complete assignments, tests, and quizzes.
- Use color effectively:
  - Avoid using different colored lettering for headings and emphasis, as it is difficult to read for many people with low vision.
  - Maintain consistency of color.
  - When using color, use dark blues and greens to maximize visibility (VisionAware, 2017).

Pierce (2014) noted that occupational therapy practitioners are also occupational scientists and, as such, seek to study occupation to understand its role in the everyday lives of those who experience restriction, gaps, and dysfunction. The distinct contribution of occupational therapy practitioners or occupational scientists is to understand the occupational needs of a person and to describe the gaps that can be filled to maximize a person’s performance. Pierce (2014) explained that, as therapists, occupational therapy practitioners identify barriers that limit participation in occupations and then design interventions that promote engagement in occupations.

Wagenfeld and colleagues (2017) suggested that occupational therapy practitioners are well suited to become involved with the design of spaces, products, services, and systems with promoting autonomy and independence. They are distinctly prepared to modify virtual environments with a focus on universal design strategies because of an in-depth understanding of the connection between a person, the environment, and occupational functioning. Additionally, Scaffa and Reitz (2014) suggested that occupational therapy practitioners can act as liaisons between clients and other practitioners.

Taylor (2017) described how occupational therapy practitioners are well suited to modifying learning environments because of their understanding of MOHO. The author described MOHO as a client-centered, occupation-focused model that emphasizes the relationship between volition (how a person is motivated), habituation (how performance is repeated over time), performance capacity (subjective perceptions of capacity), and the environment (social and physical contexts). The concepts of MOHO may be applied to improving accessibility in a virtual learning environment when providing direct service to clients, when training teachers and other educational staff, when providing education to colleagues, and when serving as educators in an online classroom.

Occupational Therapy and Universal Design

Prueett (2017) explained that the Person–Environment–Occupation Model of Occupational Performance helps identify the relationships among a person, environment, and occupation (activities). The relationship between each component affects the quality of occupational performance (function). The goal of universal design should be to maximize the fit between each element and to optimize functionality.

- When teaching, especially in an online environment, teachers do not always have the advantage of knowing the abilities of all students in a class. Teachers may not have an opportunity to know the learning styles, strengths, challenges, or skills of every student.

SUGGESTED ACTIVITIES

1. Apply the Simple Universal Design Strategies for a Virtual Environment, as discussed in this article, by creating a PowerPoint presentation to educate colleagues or clients about an intervention or another concept. Be mindful of color, font size, and use of graphics.

2. Consider educational technology that you use with clients, such as keyboarding tutorials and interactive whiteboards. Is the material being presented universally accessible for all people, regardless of ability? Is there a way to implement UDL strategies to improve accessibility?
Universal design strategies help to “level the playing field” and improve accessibility for all students, regardless of ability.

Occupational therapy practitioners are distinctly qualified to assess accessibility because of an in-depth understanding of task analysis and the effect of environmental modification (physical and virtual) on enhancing a person’s functional success as a student.

Occupational therapy practitioners understand the connection between the person, the environment, and the occupation.

**Occupational Therapy and Virtual Educational Environments**

Renn and Reason (2013) stated that higher education environments can no longer be considered without including digital environments and the online interactions students have with one another, instructors, and the institution. The authors noted that higher education institutions must adopt a mindset that addresses the digital environment to fully account for student interactions in the learning context. Applying universal design strategies to modify the online learning environment can improve accessibility for all students and can maximize the effectiveness of online teaching practice.

**Case Examples: Applying Universal Design Strategies in Occupational Therapy Practice**

- A kindergarten-through-12th-grade (school-based) occupational therapist modifies electronic media to teach children with disabilities new skills, such as how to use a keyboard.
- An orthopedic occupational therapist (hand therapist) modifies online methods to teach occupational therapy fieldwork students when using any technology, such as an iPad, laptop, or desktop computer.
- A pediatric occupational therapist uses an electronically accessed program that has been modified according to universal design principles to teach children with special needs to type or keyboard.
- Occupational therapy practitioners provide electronically based presentations, such as PowerPoint, to educate colleagues.

**Case Examples: Applying Universal Design Strategies in Teaching Practice**

- A higher education faculty member simplifies titles of hyper-links to increase accessibility to materials.
- A middle school teacher creates online lectures and notes that are universally accessible for all students, such as those found on Google Classroom.

**CONCLUSION**

Online learning has become increasingly available to students at all levels of education. Goode (2010) noted that technology is an essential element of daily campus life, and computers have become a symbol of access to a modern curriculum. The literature suggests a need for continued training for online educators about how to create online learning environments that are accessible for people with disabilities.

The online learning environment needs to be considered in much the same way that the physical learning environment is considered, with the knowledge that modifying the environment promotes learning, accessibility, and success for all students, regardless of ability. Occupational therapy has a distinct role in modifying the online learning environment, specifically in implementing and teaching UDL strategies, in a way that promotes accessibility for all students. Occupational therapy practitioners are well prepared to provide training to educators who use virtual learning environments because of their in-depth understanding of the connection between the person, the environment, and occupational functioning.

**REFERENCES**


3. Which font size is ideal in an online learning environment?
   - A. 8 to 10 point
   - B. 16 to 18 point
   - C. 12 to 14 point
   - D. 20 to 22 point

4. Which of the following is not an example of an effective universal design strategy?
   - A. Require students to use assistive devices.
   - B. Avoid unnecessary “clutter” in the classroom.
   - C. Use descriptive links.
   - D. Use larger font.

5. Which one of the following can be helpful to a reader in an online learning environment?
   - A. Descriptive hyperlinks
   - B. Multiple colors
   - C. Moving graphics
   - D. Decorative font

6. Which universal design strategy may be applied to increase the accessibility of exams and quizzes in an online classroom?
   - A. Require students to go to a testing center.
   - B. Allow for flexible time limits.
   - C. Request that students use assistive devices, such as a screen reader.
   - D. No strategies are needed to increase the accessibility of online exams and quizzes.

7. What are “accommodations” in an online classroom?
   - A. Supports and services that change how an individual learns
   - B. Glasses and contact lenses
   - C. Screen readers and other personally owned devices
   - D. Exemptions from exams and assignments

8. Which students benefit from an accessible online classroom?
   - A. Only students with visual disabilities
   - B. Only students with hearing impairments
   - C. All students can benefit.
   - D. Only students for whom English is a second language

9. What functional limitation can result from visual field loss?
   - A. Color blindness
   - B. Loses place when scanning, misses words
   - C. Difficulty seeing faded print
   - D. Double vision or blurred vision

10. What functional limitation can result from decreased contrast sensitivity?
    - A. Color blindness
    - B. Loses place when scanning, misses words
    - C. Difficulty seeing faded print
    - D. Double vision or blurred vision

11. In a virtual environment, what is the primary role of occupational therapy under the Model of Human Occupation?
    - A. Facilitate creating environments that support a person’s performance capacity.
    - B. Teach students how to use a computer.
    - C. Facilitate class discussions.
    - D. Create lectures and other course materials.

12. Which of the following established a firm legal basis that information technology procured, developed, and used by postsecondary institutions be accessible to individuals with disabilities?
    - A. Section 1 of IDEA
    - B. Section 504 of the Rehabilitation Act
    - C. The Civil Rights Act
    - D. The Employment Rights Act

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