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Universal Design in Elementary and Middle School

Designing Classrooms and Instructional Practices To Ensure Access to Learning for All Students

The Association for Childhood Education International's (ACEI) mission includes helping educators meet the needs of students in a climate of societal change. One such change is the increasing diversity of learning needs within elementary and middle school classrooms. Increased numbers of students with disabilities served within the general education classroom have contributed to this diversity (U.S. Department of Education, 2005). Students with diverse needs present a challenge for elementary and middle school teachers because it may be difficult to ensure that all students meet expectations. Under current legislation, such as the No Child Left Behind Act (2002), all students, including those with disabilities, are expected to be proficient at grade level by 2013. Similarly, the Individuals With Disabilities Education Improvement Act (2004) states that students with disabilities should have increased access to the general education curriculum and that accommodations should be designed according to the students' needs.

In carrying out the mission of ACEI and complying with federal legislation, it is important that students with disabilities have accommodations written into their individualized educational programs (IEPs) and that these students receive accessible instruction. General education teachers play a critical role in both IEP development and implementation of accessible instruction. As members of the multidisciplinary IEP team, general education teachers have a unique understanding of curricular materials, texts, equipment, and technology within the general education setting that is critical in designing appropriate accommodations. These accommodations should support teachers' other role,

that of implementing instruction that is assessable to all students. While this role may seem daunting, tools are available for designing classroom environments and instruction that are conducive to the learning of all students.

Universal Design for Instruction (UDI) is a set of principles helpful in guiding this process. UDI, designed by the Center for Applied Special Technology, is a framework that has been successful for all students, including those with disabilities in general education settings (Cawley, Foley, & Miller, 2003; McGuire, Scott, & Shaw, 2006; Pisha & Coyne, 2001; Pisha & Stahl, 2005). UDI ensures that all students have access to instruction through the following principles: 1) equitable use, 2) flexibility in use, 3) simple and intuitive, 4) perceptible information, 5) tolerance for error, 6) low physical effort, and 7) size and space for approach and use. The purpose of this article is to provide an overview of UDI, as well as practical classroom applications for elementary and middle school teachers.

Equitable Use

Equitable use means that all students can use materials, equipment, and technology in the classroom. The most common materials that can be inaccessible to students with disabilities are textbooks. As students advance in school, the emphasis on reading to learn increases and accessibility of textbooks becomes increasingly important in the content areas as students move through to middle school. Textbooks are inaccessible if students' reading levels are several levels below their grade placement, students cannot read the print due to its small size, and/or students have difficulty holding a book due to

its size and weight. However, textbooks can be made accessible to students through the use of books on tape and through digital texts (Boyle et al., 2003; Twyman & Tindal, 2006). Books on tape are available through such nonprofit organizations as Readings for the Blind and Dyslexic, a free service for school districts and individuals with reading and visual disabilities. Digital texts allow for physical access, magnification of print, changes in contrast (i.e., increased color contrast between the print and page background), as well as audio output.

Technology, classroom equipment, and materials may not be accessible to all students, due to various student characteristics. Equipment and materials may be difficult to grasp or manipulate and/or visually perceive. Fortunately, equipment and materials used for instruction can be made accessible to all students through the use of grips, changes in size and dimension, and high-contrast materials. For lower and intermediate elementary students, these materials might include: special grips for pencils or other writing utensils; adaptive scissors; use of high contrast and/or large print, pictorial directions, and/or audio directions within learning centers; use of paper with raised lines; and manipulatives that are made easier to grip through size and texture (D'Angiulli, 2007; Judge, 2006; Russell et al., 2007). Although these materials will continue to be helpful for students at the late elementary and middle school level, additional items might include high-contrast print materials and graphic organizers or diagrams, and the use of graphic organizers and diagrams with raised lines (D'Angiulli, 2007; Russell et al., 2007).

Technology difficulties include becoming "lost" when searching the Internet for research, the computer font being too small or lacking color contrast, motor difficulties interfering with mouse manipulation, keyboard keys being too small, or the keyboard's lack of color contrast. As students progress through elementary and middle school, they will use technology more independently for research. Technology solutions for these students include the creation of web quests, in which the necessary websites are linked and/or the sites are contained within a single main site (Skylar, Higgins, & Boone, 2007). For all students, regardless of their grade level, computer equipment can be modified through the use of mouse balls that accommodate for fine motor difficulty, high contrast, and/or large-print stickers placed on top of keyboard keys. Keyboards are also available with large keys. Computer software is available to provide audio output so that print can be read to the student. The contrast of the screen and print can be adjusted to provide appropriate color contrast.

Flexibility in Use

Flexible use means that instruction and accompanying activities accommodate a wide range of individual

preferences and abilities. Instruction can be designed in a variety of ways to accommodate a variety of learning strengths. It is helpful to design instruction using several different modes in order to make learning accessible for students with diverse learning needs.

Visual Representation. Adding visual representations in the form of graphic organizers or schematic maps helps students organize concepts and information (Boulineau, Fore, & Hagan-Burke, 2004; Ives, 2007; Lovitt, & Horton, 1994; McCoy & Ketterlin-Geller, 2004; Williams et al., 2007). These tools also help students recognize relationships between ideas and concepts. Students who have difficulties processing information, and students who lack background knowledge, may have difficulty connecting ideas and understanding how ideas come together to form overall concepts. Emphasis on pictures and symbols may be more appropriate when designing graphic organizers for elementary students. For middle school students, the use of graphic organizers or schematic maps may be helpful as instructional advance organizers and as instructional guides throughout units. The use of color, size, and shape also can be helpful in emphasizing relationships and hierarchies within graphic organizers. Other ways to appeal to visual learners at all grade levels is through pictures and videos. Visual depictions of information and relationships also may be helpful for memory or retention by providing students with an avenue for "picturing information in their mind."

Hands-on Activities. Hands-on activities can be helpful for students, at all grade levels, who have difficulty acquiring information by more traditional means (Butler, Miller, Crehan, & Babbitt, 2003; Cass, Cates, Smith, & Jackson, 2003; Kerry-Moran, 2006; Kinniburgh & Shaw, 2007; Mastropieri et al., 2006; Witzel, Mercer, & Miller, 2003). Although these types of activities may be associated with science in the form of experiments and demonstrations, they provide opportunities throughout content areas. In mathematics, the use of manipulatives is a way to increase understanding of concepts and procedures, regardless of grade level. Although using and managing the use of manipulatives may be challenging, research has shown that students with learning disabilities need an average of three experiences with manipulatives in order to understand mathematical concepts (Mercer & Miller, 1992). In addition to building understanding, hands-on and participatory activities provide students who have difficulty expressing themselves through oral and written language with an opportunity to demonstrate their understanding.

Assignment Completion. It is important to assess students' understanding of concepts and ideas; however, providing one avenue for expression of one's understanding may lead to inaccurate results. For example, students with learning disabilities in writing may not be able

to fully express their ideas in writing, but they could discuss them in detail. Offering assignment or project menus could provide a variety of ways in which students can demonstrate their understanding. A menu allows all students to choose their preferred format without singling out particular students. For example, students might be given the option of writing a paragraph (for younger students) or an essay (for older students), an oral report to a group or through audio recording, or a multimedia presentation. The choices offered should each allow for appropriate assessment of students' understanding of the target objective or concept.

Another way to be flexible about assignment completion throughout elementary and middle levels is through cooperative grouping. Cooperative groups should be structured so that all members of the group have roles and responsibilities. These roles should be tailored to students' strengths and weaknesses and lead to active participation for all students. Each student should be accountable for his or her contribution to the group, as well as for the overall group's performance. The provision of individual roles ensures that all students actively learn and contribute, rather than only a few members of the group completing the work.

Simple and Intuitive

Simple and intuitive means that instruction is easily understood, regardless of students' experience, knowledge, or language skills. This includes priming students' background knowledge prior to beginning instruction. Priming background knowledge involves explaining how new information is connected to prior knowledge and experience. For example, an instructional unit about the American Civil War might include discussions about instances when students might have felt that another person or group did not attend to their point of view or needs. The experiences of students and how this discussion is moderated will differ depending on the grade level. Another way to make instruction simple and intuitive for elementary and middle school students is through analogies between new concepts and well-known concepts. It is important to be aware of students' diverse experiences while creating or designing these analogies, so that all students easily connect the two concepts.

Using consistent language is another way of making instruction simple and intuitive for elementary and middle school students. Students with language processing deficits and/or students who are second language learners have difficulty understanding instruction when each explanation involves different vocabulary and terminology. Therefore, using similar language each time an explanation is provided will lead to more efficient learning and understanding. In addition, language should be not only appropriate for a given skill, task, or

concept, but also easily understood by students. Keep explanations as simple as possible, adding vocabulary instruction, if needed.

Perceptible Information

Perceptible information refers to that information that can be perceived regardless of skill and ability. This includes the use of instructional materials with appropriate color contrast for students with visual impairments. Black and yellow provide the highest color contrast, and computer screens, PowerPoint presentations, keys on computer keyboards, and handouts can be adjusted to allow for increased visual perception. Seating within the classroom also can provide for increased perception. Placing students near the instructor and away from windows and hallways will increase students' ability to hear, see, and attend to instructional activities. Assignments and instructional materials also can be made more perceptible by changing their format. This begins with directions that are written clearly and at a level that students with various reading abilities can understand. Format also includes the amount of space between activities or problems, the use of lines for written responses, the layout, and the order of questions. Activities and assignments that involve written problems or scenarios can be adjusted for readability. Tests and quizzes that accompany textbooks may not be written at a level that all students understand. The wording of questions can be changed so that students are assessed based on their level of subject matter knowledge, rather than on their reading ability.

Tolerance for Error

Tolerance for error means that students have the opportunity to engage in ongoing assignments and projects. This allows for revision and editing over time, and students receive credit for correcting their errors. Students have the opportunity for feedback and ongoing learning. Over time, students learn from their mistakes and practice the appropriate skill, an opportunity that is lost with one-time assignments. These ongoing assignments and projects would be appropriate, regardless of students' grade placement.

Low Physical Effort

Low physical effort means that all students have access to materials and activities without great physical effort. The use of technology can decrease the amount of physical effort (Bahr & Nelson, 1996; Strassman & D'Amore, 2002; Tumlin & Heller, 2004). For example, if writing is physically taxing for students with fine motor difficulties, then the use of a keyboard can be of assistance. Hardware, software, and accessories are available to make computers accessible to students with more significant motor difficulties. Classroom materi-

als, such as scissors, writing utensils, lab equipment, and desks, are all available in versions that are easily accessible for students with physical disabilities (Judge, 2006). These accommodations allow students to focus their attention and energy on learning rather than on manipulating materials.

Size and Space for Approach and Use

Size and space for approach and use means enough space is available so that all students can participate. The classroom is set up so that all students can maneuver throughout the room and participate in a variety of

activities without excess physical effort. Students with physical disabilities have enough space to engage in the same types of activities as students without disabilities. Movement throughout the room and transition to activities is facilitated by its layout and design. Enough space is available between learning centers within elementary classrooms and middle school classrooms. Students should be able to move easily from small-group instruction to other areas within the room. As students begin to change classrooms, backpacks and other student materials can create clutter and hazards for students with visual impairments, physical disabilities, and/or

Figure 1

MR. JACKSON'S 3RD-GRADE CLASSROOM: UDI EXAMPLE FOR ELEMENTARY LEVEL CLASSROOM

Mr. Jackson teaches 3rd grade at North Hills Elementary School and utilizes UDI in order to make his classroom accessible to a diverse group of learners. Mr. Jackson's room includes three types of learning centers (mathematics, writing, and reading), a classroom library (which includes audio books), an area for small-group instruction, and an area for whole-group instruction. Therefore, he has flexibility in his grouping, allowing him to individualize instruction for a small group while others are engaged in alternate learning activities. He places the learning centers along one side of the room, far enough apart so that students in one center will not be distracted by students in another, but still allowing easy movement from one to another. The large group area consists of grouped desks (conducive for cooperating group work) placed in a semicircle formation in front of the classroom's whiteboard. The classroom library (close to the reading center) and the small-group area are situated on each end of the room. Mr. Jackson has instituted a class book club in which students chose books based on the groups' interests. Mr. Jackson has acquired audio-books from the Association for the Blind and Dyslexic so that all students can participate fully in the experience. Each learning center includes written (large print, high contrast) directions, pictorial directions, and audio directions through headsets. Menus of activities also are included for each center in order to differentiate them based on students' strengths. The materials for the centers are modified according to students' needs. For example, the math center's manipulatives are large, with high-contrast coloring. The keyboards are portable and can be moved throughout learning areas. The students' written work can be saved on the classroom computer so it can be downloaded for editing and printing later.

Figure 2

MS. VARGAS' 7TH-GRADE CLASSROOM: UDI EXAMPLE FOR A MIDDLE LEVEL CLASSROOM

Ms. Vargas is a member of a four-person team and teaches 7th-grade science at Green Oaks Middle School. She utilizes the principles of UDI to make her science class accessible to diverse groups of learners. Ms. Vargas' science textbook package includes audio versions of the text that she makes available to students with visual and learning disabilities. Ms. Vargas has acquired software and hardware that allows students to scan print materials into the classroom computer, which then converts the print into an audio format. Prior to beginning an instructional unit, Ms. Vargas provides all students with a schematic map for the unit. She refers to the map often and highlights important connections between concepts learned previously and those in the current lesson. When instruction involves lecture and note taking, Ms. Vargas provides all students with an outline that includes key words and a hierarchical structure to ensure that students have useful study notes. Students also may audio-record classroom instruction. During these lectures, Ms. Vargas uses PowerPoint presentations with a large, high-contrast font. During laboratory activities, students work in pairs, with each person responsible for specific duties. Plastic (rather than glass) containers and equipment are used and materials are kept on a series of lazy Susans so that they may be accessed easily. When needed, Ms. Vargas modifies the procedures so that larger weights and volumes can be used, allowing students with fine motor problems to grip and move containers and objects more easily. Laboratory reports can be produced either in writing (handwritten or word processed) or as an audio recording. More complicated lab reports and projects are ongoing assignments in which students complete the product in stages and receive feedback.

students who use wheelchairs. Providing a special area within the room for these materials or using individual storage crates under chairs or tables can alleviate this problem.

Conclusion

The scenarios in Figures 1 and 2 are from elementary and middle level classrooms that exemplify different UDI principles in action. Figure 1 describes a 3rd-grade classroom in which the following principles are emphasized: equitable use, flexibility in use, perceptible information, low physical effort, and size and space for approach. Figure 2 describes a 7th-grade classroom in which the following principles are emphasized: equitable use, flexibility in use, simple and intuitive, perceptible information, tolerance for error, and size and space for approach.

Students with disabilities have IEPs that are written each year by a multidisciplinary team, including, but not limited to, general education teachers, special education teachers, parents, and administrators. The general education teacher has the most experience and informa-

tion about the curriculum, activities, and materials used within the general education setting. In order to ensure that instruction is accessible to all students, appropriate modifications and accommodations need to be planned and implemented. The general education teacher is a critical participant in this process because of his or her knowledge of the general education setting. Parents, special education teachers, and administrators might not be as knowledgeable about what might be needed within this setting. The general education teacher could add valuable suggestions about modifications and accommodations that might be otherwise overlooked. The principles of universal design should guide this planning process. The general education classroom should be thought of with regard to the students' accessibility, specifically in terms of equitable use, flexibility in use, simple and intuitive, perceptible information, perceptible information, tolerance for error, low physical effort, and size and space for approach and use.

The No Child Left Behind Act (2002) requires that students with disabilities perform proficiently on grade

Table 1 BOOKS THAT PROVIDE RESOURCES AND ADDITIONAL INFORMATION ABOUT IMPLEMENTATION OF UNIVERSAL DESIGN FOR INSTRUCTION

Rose, D. H., Meyer, A., & Hichcock, C. (2005). *The universally designed classroom*. Cambridge, MA: Harvard University Press.

This book provides an introduction to Universal Design and is useful for teachers, administrators, and parents. It includes strategies and resources for creating a classroom that provides access to the general education curriculum for all students.

Rose, D. H., & Meyer, A. (2002). *Teaching every student in the digital age: Universal design for learning*. Alexandria, VA: Association for Supervision and Curriculum Development.

This book provides an overview of Universal Design for Learning, as well as real-world strategies for implementing Universal Design in the classroom. The authors explicitly connect ideas and concepts, using graphic organizers and examples throughout the book.

Council for Exceptional Children. (2005). *Universal design for learning*. Upper Saddle River, NJ: Prentice Hall.

This book serves as a practical guide to implementing Universal Design in the classroom. It includes a case-based scenario about teachers' experiences with Universal Design. Discussion questions throughout the book offer opportunities for application and reflection upon the content.

Table 2 INTERACTIVE WEBSITES THAT PROVIDE TOOLS FOR THE IMPLEMENTATION OF UNIVERSAL DESIGN FOR INSTRUCTION PRINCIPLES

Websites

Lesson Builder: <http://lessonbuilder.cast.org>

This site provides models and tools to create and adapt lessons in order to increase accessibility for all students. Model lesson plans across content areas and grade levels are included.

Book Builder: <http://bookbuilder.cast.org>

This site provides information and the tools to create engaging digital books for students. Universally designed books will engage, and provide access for, diverse groups of students.

Creating Accessible WebQuests and Web-based Student Activities: www.4teachers.org

This site offers tools and resources to integrate technology into the classroom. These include Web lessons, quizzes, rubrics, classroom calendars, and other tools for student use.

level in all areas by 2013. These are high expectations to meet. Therefore, it is critical that all students have access to instruction within the general education classroom. Students' IEPs provide for the necessary accommodations and modifications for access to instruction. The multidisciplinary team who creates a student's IEP is responsible for assessing the student's needs and designing the necessary modifications. The general education teacher has unique knowledge of the curricular standards, instructional activities, materials, and physical design of the classroom. The awareness of these factors, as well as the knowledge of the principles of universal design, provides teachers with the tools necessary to fully participate in this process of meeting students' needs and ensuring that all students have access to instruction.

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