

Leveraging Technology



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*“We should differentiate instruction when doing so would be the best means to solve a problem.
We should use technology in education when doing so would be the best means to solve a problem.”*

– Amy Benjamin in *Differentiated Instruction Using Technology: A Guide for Middle and High School* (2005) p. 9.

In today’s classrooms, a wide range of technologies are creating new options for differentiated instruction and for the inclusion of students with disabilities. Technology can assist teachers in providing support, choice and flexibility to students. It also can directly support the learning of individual students with wide differences in their abilities to see, hear, speak, move, read, write, understand English, attend, organize, engage and remember.

In other words, there are numerous ways that technology in the classroom can be leveraged to address diverse learning needs. To do this efficiently and effectively requires careful selection, purposeful planning and thoughtful implementation. Not all technology is equally useful, for individual students or for educational purposes in general. Effective technology aligns with principles of universal design for learning (UDL) and provides multiple means of:

- *representation*—gives learners various ways of acquiring information and knowledge
- *engagement*—taps into learners’ interests, offers appropriate challenges and increases motivation
- *expression*—provides learners with alternatives for demonstrating what they know.

This chapter provides information on planning for and using technology as part of a differentiated instruction approach. It offers strategies and ideas for using technology to enhance instruction, motivate and engage students, offer choice, ensure accessibility, create flexible groupings and scaffold instruction. Finally, recognizing that some students will need specialized technologies, this chapter provides guidelines for choosing assistive technologies for specific learning needs.

Planning for instruction

Technology should be used in natural and substantial ways and should be built into activities, rather than tacked on. The utilization of technology is only one part of any instructional solution. Thoughtful planning, ongoing monitoring and assessment and on-the-spot instruction and support will still be needed.

As you plan for instruction that will include the utilization of technology, consider the following questions related to students, learning environments, training and tasks.

- Why do I want or need technology in my classroom?
- What do I want technology to do (that I could not do without it)?
- What will this technology do for the students in my classroom?
- What skills and strategies will students need in order to use the technology?
- Do I have the skills and confidence I need to use technology effectively in the classroom?
- Is appropriate and effective equipment and software readily available and accessible for the students in my classroom?
- How will technology affect what I do (the way I plan, teach, assess and evaluate)?
- How will technology affect the students and their learning?
- Does everyone (e.g., students, parents, educational assistants, administrators) understand what is happening and why?
- Do I have access to ongoing support?

It also is critical to assess the value and usefulness of a particular technology, including the following factors:

- level of independent use by students
- unique capability and limits of the tool
- usefulness for task completion
- ease of use
- accessibility of equipment.

For many tools, it may not be so much a question of how to use the technology, but more of a question of knowing when and why to use it.

Enhancing instruction

A differentiated instruction approach incorporates a variety of instructional methods and materials. The use of speech, text and visuals are key to most instructional strategies, and these three modes of communication can all be enhanced by the use of technology.

Speech

Speech is the most frequent mode by which teaching happens. Studies have found that, on average, students spend 45 percent of their school day involved in listening activities.



Speech has two major advantages as a mode of teaching; it is inherently dynamic and it has the power of expression. Teachers can add information quickly and simply by saying more or saying it in a different way. Extra information also can be added through the tone, rate, inflection and volume of the speaker's voice.

The major limitation to speech as an instructional strategy is that it is transitory; i.e., once something is said, it is gone. This can create challenges for students, particularly students with disabilities. Students who do not hear well or who have attention problems may miss some of what is said. Students with processing or short-term memory difficulties may be unable to process or remember significant chunks of speech.

Technology can be leveraged to overcome speech-related barriers in a variety of ways. Consider the following sample strategies.

- **Investigate the feasibility of a sound field system.** This technology, which includes a microphone and speakers, ensures all students can hear what is being said in the classroom.
- **Pair speech with visuals or key words on an interactive white board or a digital slide show.** This extra support cues students to what is important, and reinforces the information, using another modality.
- **Use videos and audios clips that align with the learning activity.** Students can return to these links on their own to revisit and review the material.
- **Record key learning activities on digital recording devices.** Digital recordings create a permanent record of the speech. This digital recording can then be reviewed by or with students at a later time.

Printed text

Printed text is central to our culture and a key component of much of the instruction and many of the learning materials found in Alberta classrooms. Unlike speech, text captures information and ideas in a permanent way, so students can return to it as often as needed. However, text poses challenges to a number of students. Some students struggle with decoding text; others lack the background knowledge needed to manage new information presented in print.

Technology can be leveraged to overcome print-related barriers in a variety of ways. Consider the following sample strategies.

- **Provide digital versions of text.** These more flexible versions of a text allow teachers and students to change how information is displayed. Digital versions of texts also allow students to use software that reads the

text aloud. Many electronic versions of textbooks and popular literature are available for free or for sale from many sources, including the following:

- WikiBooks: http://en.wikibooks.org/wiki/Main_Page
- Google Books: <http://books.google.com>
- Project Gutenberg: http://www.gutenberg.org/wiki/Main_Page.

These digital texts often include enhanced and additional materials such as glossaries, visuals and summaries.

- **Present text in flexible formats.** Digital text can be visually enhanced in numerous ways. The font size can be increased, the colour of the font and the background can be changed, and the contrast between the text and the background can be modified to suit the needs and preferences of individual readers. Also, the amount of information displayed at one time can be controlled.
- **Provide access to text-to-speech software.** Having digital text read aloud can benefit students with reading difficulties and students with vision loss. This technology may be a tool they use throughout their lives. For other students, including those students who are learning English as another language, text-to-speech software may be used to scaffold their learning until they develop stronger independent reading and language skills. For still other students, having material read aloud may be a preference (especially for students with attention difficulties).
- **Provide access to online dictionaries and glossaries.** Many students will benefit from using these supports on an as-needed basis.
- **Provide content in alternate formats.** Look for “considerate text” versions of popular novels (simplified vocabulary and storyline), synopses or outlines; these versions are often available online. Graphics novels are increasingly more available and can be engaging for students who struggle with print or just prefer the more visual medium. Video versions of key content also may be more engaging than print text for many students. Teachers have used video versions of books and resources for many years. Today’s technology makes this option easier, faster and more accessible. There are many readily available videos, many of them free, that present various concepts, ideas and pieces of literature. Some of these videos also are captioned and a range of students can benefit from this technology, not only students with hearing loss. A list of alternate formats of authorized novels for the Alberta English language arts program is available at <http://www.education.alberta.ca/admin/technology/atl/resources.aspx>.

Images

Images can be a powerful and efficient way to communicate ideas and concepts. Many teachers use images to support teaching and learning in the classroom for these reasons. Consider the following picture.



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To describe in words what is happening in this picture would take at least a few sentences. Even then it is doubtful that the listener or reader would get the full picture. This image elicits feelings and ideas in the viewer that are difficult to express in other ways.

At the same time, images, like other modes, have certain limitations. The use of images creates extensive barriers for students with visual impairments. As well, students who are colour-blind or have other sensory-processing challenges will be challenged by graphics in many instances. Even if students can all see equally well, they may interpret an image in many different ways, which may not be the way the teacher intends.

Technology can be leveraged to overcome image-related barriers in a variety of ways. Consider the following sample strategies.

- **Present digital images in flexible formats.** Enlarge images or modify the colour scheme to make them more visually accessible.
- **Use text information that is supported by visuals and visuals that are supported by text.** There are many digital resources and Web sites available that use multimedia to create interactive learning experiences (e.g., roll-over text to explain visuals, hyperlinks to background information that could include additional visuals).

Motivating and engaging students

Research suggests that a number of elements are essential to motivating and engaging students, including:

- positive relationships and school climate
- meaningful feedback
- hands-on, active work
- variety and attention to learning preference
- relevant and interesting learning tasks
- student voice and choice
- learning in context and making real-world connections.

Technology can be used to create engaging learning activities that address many of these elements. For example:

- **blogs and interactive Web sites** can enhance communication and build virtual communities that create positive relationships and a sense of belonging
- **digital learning objects** can provide immediate and nonjudgmental feedback for improving performance
- **web sites** can provide easily-accessed information for hands-on and active work
- **search engines** make it possible to locate information and activities that appeal to a wide range of interests
- **discussion boards, online communities and e-mail** make it possible for students to connect to learning and gather and share information and ideas in real-life contexts.

Specially selected technologies and tools can address diverse learning styles and preferences. The flexibility and availability of digital resources also enhances opportunities for student choice.

Offering choice

One of the hallmarks of a differentiated instruction approach is providing learners with choices in how they interact with new information and ideas, practise skills and demonstrate what they know. Many teachers provide students with choice in the types of materials they use, products they create and activities they do. Technology can expand and enhance this range of choices.

Ensuring accessibility

The term *accessibility* refers to how easily, how effectively and how independently an individual student can use a learning resource. Resources with flexible formats give students the choice, control and independence they need to be successful in their learning. Flexible resources also give teachers the tools they need to better meet the diverse needs of students in their classrooms.

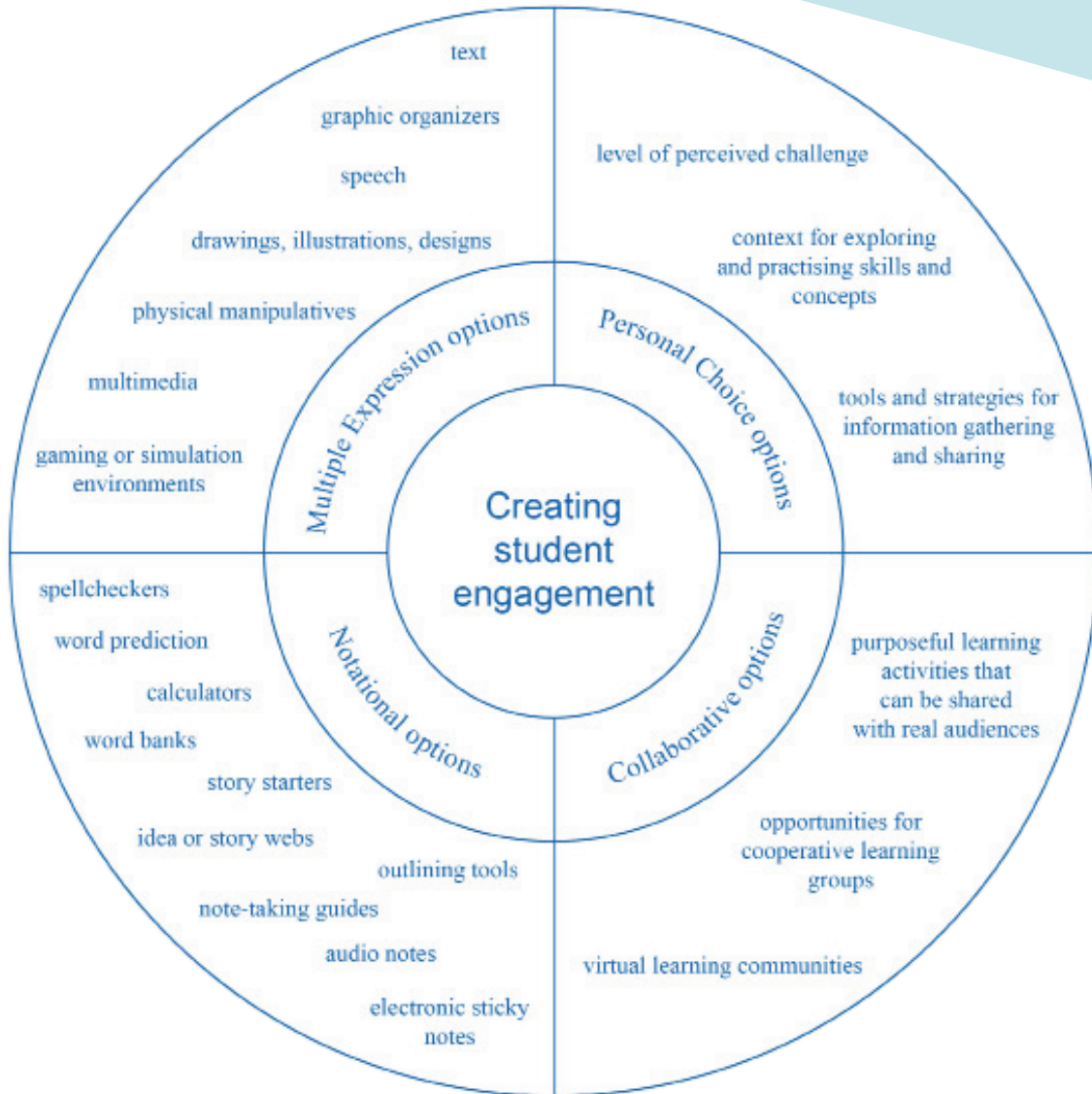
Resources can enhance accessibility by:

- creating student engagement
- building student understanding
- displaying information.

The following three graphics illustrate the types of options and features that make learning resources more accessible and more responsive to a wide range of learning needs, preferences and strengths.

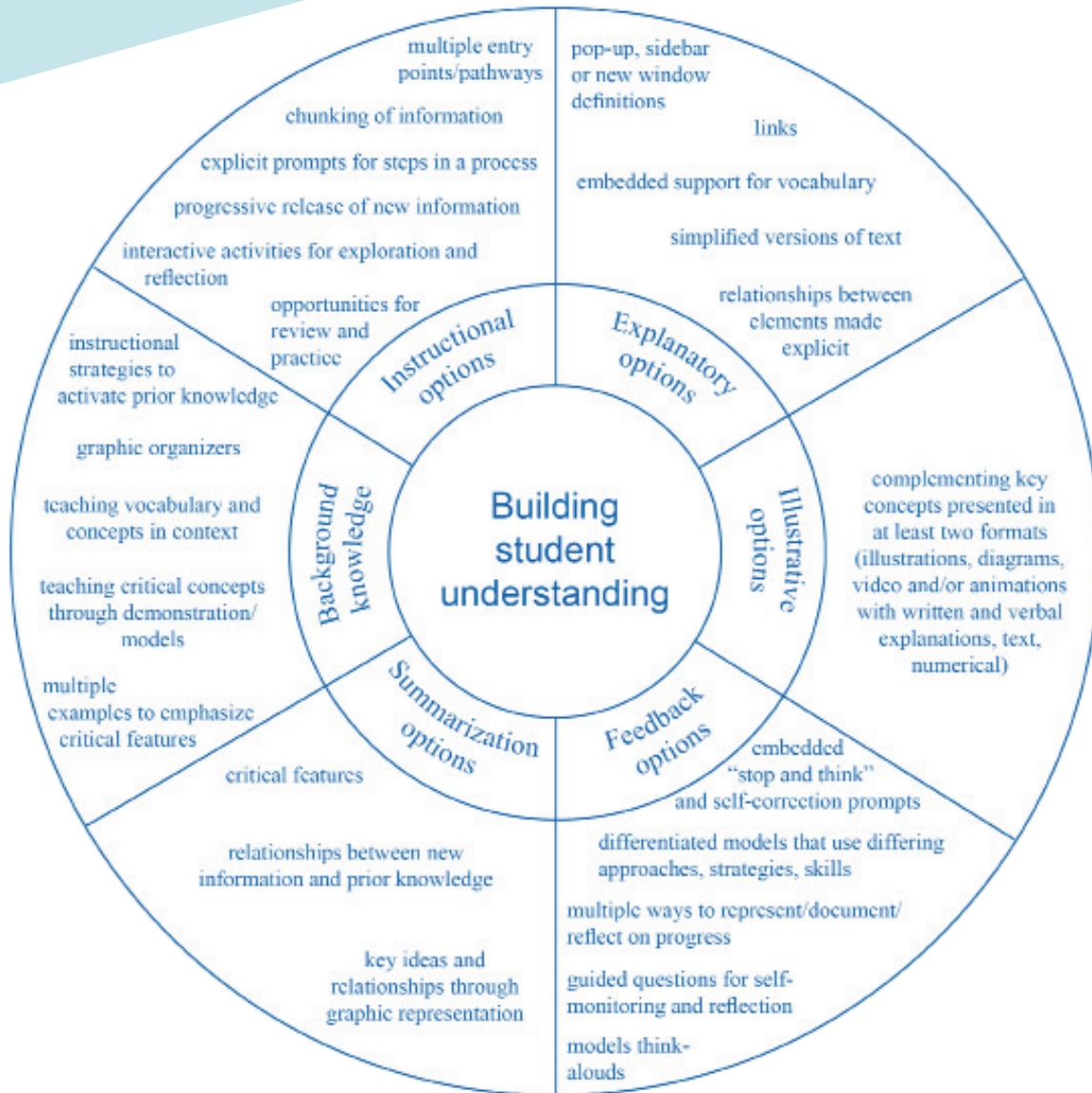
Creating student engagement

These types of options and features create multiple opportunities for students to explore, interact with, personalize and reflect on new skills, information and concepts.



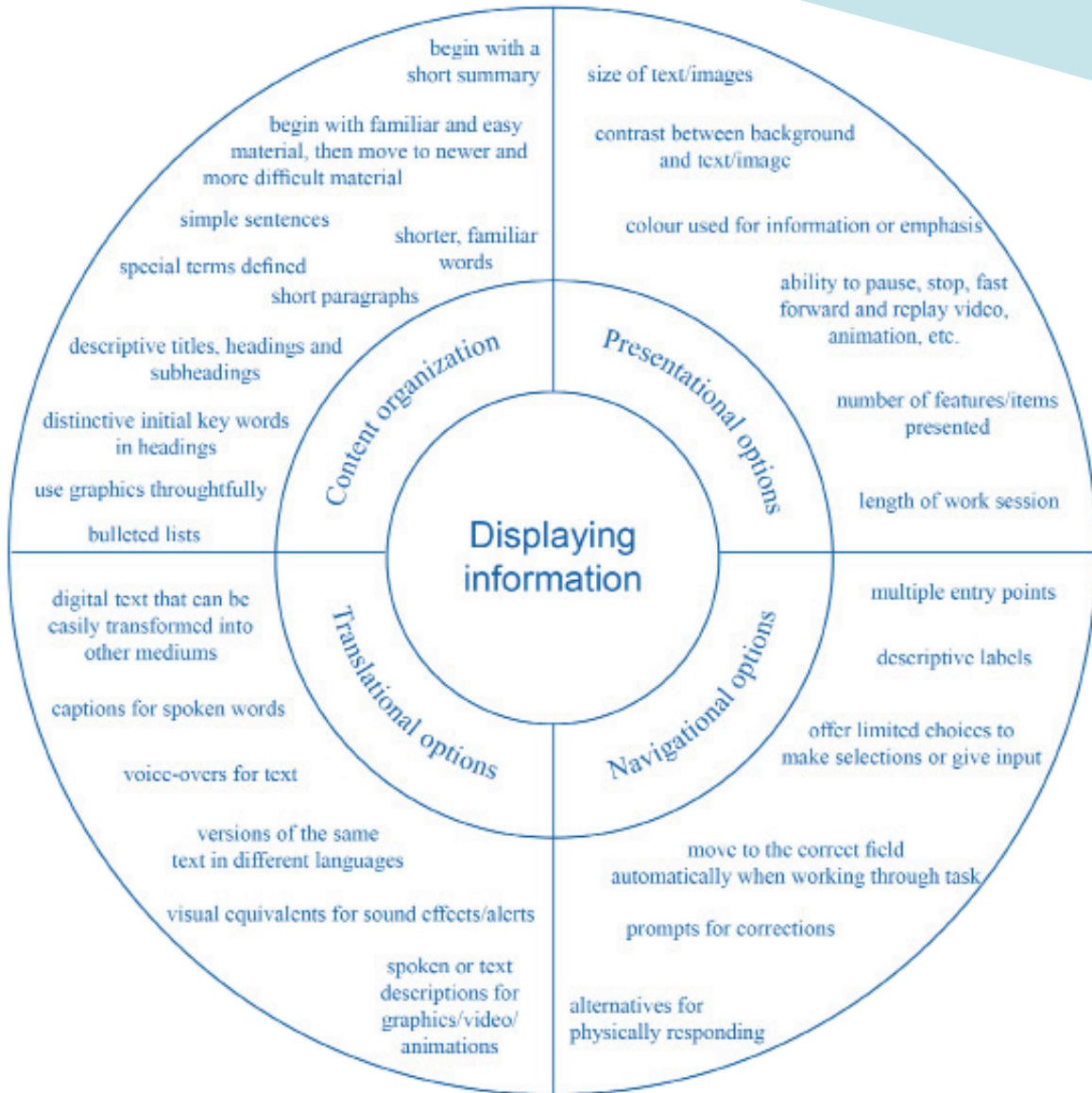
Building student understanding

These types of options and features create multiple means of providing instruction, explanation, illustration, summarization and feedback.



Displaying Information

These types of options and features create multiple means of representing and presenting information effectively.



Creating flexible groupings

The utilization of technology can be integrated into activities with various groupings including:

- whole group (e.g., using interactive white boards to introduce new concepts, watching and discussing a video)
- small groups (e.g., completing WebQuests, developing a digital slideshow)
- partners (e.g., exploring Web sites, going on a virtual tour, playing an interactive game)
- individual (e.g., building an information web, reading a digital text).

Many technologies can be used in a number of grouping types, depending on the specific activity and student abilities, needs and preferences.

Scaffolding instruction

Technology utilization has the potential to provide flexible, unobtrusive scaffolds for learning. To do this effectively we need to:

- get to know the learner
- use this information to consider the implications for that student's learning
- match potential technology solutions to the student's particular abilities, preferences and interests
- build in supports and structures that will ensure the student is successful.

Learner and classroom profiles should include information about student comfort levels, preferences and current uses of technology. Many students today have spent their entire lives surrounded by and using computers, video games, digital music players, video cams, cell phones, and all the other toys and tools of the digital age. Matching student needs with potential technology solutions is a critical part of a differentiated approach.

Consider the following examples of five students who demonstrate learning abilities and needs that are becoming increasingly more common in Alberta classrooms. We need to understand these types of learners and their individual needs in order to provide them with the supports and choices they need to be successful in their learning.

Student characteristics	Implications for learning	Technology solutions that could provide potential scaffolds
<p>Mary</p> <ul style="list-style-type: none"> • quiet; seems shy • rarely speaks in class and never volunteers an answer • has difficulty hearing what others are saying, including the teacher’s instructions 	<ul style="list-style-type: none"> • misunderstands or makes mistakes because she didn’t hear well • doesn’t speak up because she is afraid of giving an incorrect or inappropriate response 	<ul style="list-style-type: none"> • Investigate feasibility of sound-field system. • Pair verbal instructions with key words posted on board. • Create opportunities to answer in private; e.g., online journal.
<p>Josh</p> <ul style="list-style-type: none"> • has many great ideas and can tell you about them with great enthusiasm • shuts down when he has to put these ideas on paper 	<ul style="list-style-type: none"> • struggles with printing and spelling • spends so much of his energy getting the words “right” that he loses his energy and his writing does not reflect those great ideas he can talk so easily about 	<ul style="list-style-type: none"> • Provide instruction in keyboarding skills. • Investigate using speech-to-text software, digital recording and/ or word prediction software. • Use storyboarding and mindmapping tools.
<p>Jamila</p> <ul style="list-style-type: none"> • recent refugee • limited classroom experience • has conversational English but has difficulty understanding the language of instruction 	<ul style="list-style-type: none"> • often confused as to what she is being asked to do • has less background knowledge than most other students in the classroom • other students (and most teaching staff) assume she is fluent in English because of her conversational skills 	<ul style="list-style-type: none"> • Use online tutorials to provide ongoing language instruction. • Provide access to online dictionaries and glossaries. • Use web links, photo galleries, simulations and other tools to help build background knowledge.





Student characteristics	Implications for learning	Technology solutions that could provide potential scaffolds
<p>Susan</p> <ul style="list-style-type: none"> • blind since birth • understands all concepts at or above grade level • reads Braille 	<ul style="list-style-type: none"> • is frustrated that more novels and other print material are not available to her 	<ul style="list-style-type: none"> • Provide timely Braille translations of core learning materials. • Consider specialized assistive technology including scanner, refreshable Braille and screen reading software. • Do online searches for additional texts and literature available in Braille.
<p>Taylor</p> <ul style="list-style-type: none"> • has lots of great ideas • limited attention span of only a few minutes; is easily distracted (e.g., by a plane flying by or some random thought that pops into his head) • when playing games on his Wii he is focused, engaged and attends to many details at the same time 	<ul style="list-style-type: none"> • starts many interesting projects but seldom finishes anything • minimal interest in most assignments 	<ul style="list-style-type: none"> • Look for technology that will reduce distractions (e.g., sound-blocking headset, online work space with minimal extraneous information or features). • Develop customized online planning tools for planning and completing projects. • Find online games or simulations that are aligned with learning outcomes.

Choosing assistive technologies

Assistive technology is any technology that increases, maintains or improves the functional capabilities of an individual with disabilities. As the utilization of technology becomes more and more common place in learning environments, the line between educational technology and assistive technology is blurring. Many tools that are currently considered assistive technologies can offer benefits to all students.

The benefits of assistive technology for students with disabilities includes:

- building on individual strengths
- accomplishing higher rates of learning and improved achievement
- completing academic tasks independently, including tasks that they might not otherwise be able to handle unaided, leading to a greater sense of self-efficacy
- addressing a number of literacy and numeracy challenges.

When considering assistive technology, it is important to be aware of the following limitations.

- Assistive technology does not *replace* the teaching and learning process. It is a tool that *supports* teaching and learning.
- Assistive technology is just one element in a student's educational programming. Students with disabilities may have a number of areas of need. Technology is only one of a number of tools that they may need.
- Not all assistive technology tools are appropriate for all students with disabilities. It is important to identify learning tasks and outcomes, evaluate barriers to accomplishing those tasks, and match the characteristics of technology with the student's individual learning profile.
- Some students will need basic keyboarding skills to maximize the effectiveness of assistive technology. Keyboarding instruction should begin when students are developmentally ready (typically around Grade 3) and instructional sessions should be short, motivating and incorporate real-life applications.

The following sections list some common assistive technology tools to support reading and writing, mathematics and communication. Many other tools may be available, depending on the needs of the individual student. A free, downloadable student handbook for choosing and using assistive technology, called *How Can I Try That?*, is available at www.wati.org or www.otap-oregon.org.

Tools to support reading and writing

There are a range of technology tools that support readers and writers of varying abilities.

Text-to-speech software (and screen readers) allows students to hear digital text read aloud by a synthesized voice. This technology requires digital versions of print, and may include a scanning capacity to convert print to digital text. On many programs students can control the pace of the reading and can choose to have the computer read individual words or whole passages. This type of technology is particularly helpful for students who can make sense of spoken language but have difficulty decoding text. This software can reduce frustration and allow for more complete comprehension of text. It allows students to access textbooks, assignments, books and literature independently and effectively. It may even increase the motivation to read, because for some students using this software provides their first opportunity to enjoy literature independently, successfully and comfortably.

Word processing software can address fine motor difficulties and increase legibility and quantity of written expression. Most word processing software also includes a number of standard features that can assist students with writing; for example:

- *spell-checking tools* can reduce some spelling difficulties
- *cut-and-paste* features can allow students to manipulate text more easily when editing, thereby saving time and physical effort
- *built-in thesaurus* can assist students who have difficulty finding the right words.

Word prediction software can be installed on computers that run word processing software. Current research identifies it as the single most effective technology tool for assisting written expression. Word prediction does not give the answer to any question, but it does provide students with an immediately available vocabulary list, speeding up the writing process by allowing writers to find the most appropriate word. This technology also can reduce spelling mistakes, increase motivation, and help students who have difficulty with the physical task of writing. It also can increase the quantity and overall quality of written work.

Planning and organizing software can help students organize their writing, a skill essential for high-quality written expression. Software programs that help students structure their writing are usually visual in nature, allowing students to:

- create webs that emphasize relationships between ideas
- manipulate categories of ideas and choose where to place them
- see an outline of the topics and subtopics of their writing
- easily manipulate and reorganize the text at any time
- use a built-in or teacher-created template as a basis for their work.

Speech-synthesis software can convert text on the screen into aural speech. For some students with cognitive and communicative disabilities, this software supports writing as well as reading. Hearing the text that they have produced can increase student independence and self-monitoring of their own writing. This software also will help students improve spelling skills.

Speech-recognition software is an affordable tool that works with most word processing systems. It allows students to use a microphone headset to dictate what they want the computer to type. Speech-recognition software has been used in many special education settings over the last 10 years, with varying levels of success. It requires that the user trains the computer to recognize his or her voice patterns and pronunciations by reading specific material repeatedly, for up to several hours. The more a student uses the program, the better the program gets at recognizing that student's voice, eventually reaching about 90 percent accuracy.

Speech-recognition software is designed for users with strong communicative or cognitive abilities and good visual vocabulary skills. Although most useful for individuals who are verbally fluent, with support, students who are less verbally fluent can benefit from the use of this tool.

There are a number of cautions to consider when matching this tool to an individual student, including the following.

- Initial training can be time-consuming, for both students and teachers.
- Even after successful initial training, the program will make some mistakes (students need to proofread and correct mistakes for accuracy to improve).
- There are a number of guidelines to learn when dictating, such as pausing the program to talk or ask a question.
- Visual fatigue can set in for some students, making the program less effective when it used for extensive periods of time.
- The technology may be distracting to other students in a large classroom setting.

Tools to support mathematics

There are a number of technology solutions that can support students in learning mathematics, including the following examples:

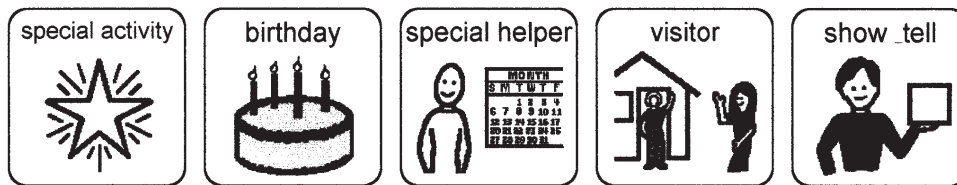
- calculators with special features such as large display screens and speech synthesis; e.g., “talking calculators” that vocalize data and resulting calculations
- mathematical overlays for specialized keyboards
- software that allows students to manipulate objects and geometric shapes
- text-to-speech software that assists in reading and writing for literacy-related tasks in mathematics; e.g., word prediction programs that can be customized to recognize mathematical terms
- online games for the development and practice of numeracy skills.

Tools to support communication

Software that encourages the use of language skills, including grammar and vocabulary development has the potential to help all students, particularly those with communication difficulties. This type of software may use a variety of techniques such as videos, audio, games and computer-assisted instruction.

Some students have difficulty with verbal communication, for both receiving and expressing information. Visual supports, such as picture symbols, can help these students make sense of verbal information and printed text. The primary purpose of these visual tools is to enhance student understanding. Visuals also can be used to support students with limited verbal abilities to communicate; e.g., ask for help, make choices, communicate needs.

Visual tools can be essential in assisting students with communication difficulties to become active, successful participants in the learning process.



Picture communication symbols also can be used by classroom teachers for creating materials to enhance language and literacy skills instruction for all students. Using a software program such as Boardmaker, picture word cards can be generated for a wide range of topics or student activities. Picture symbols are useful for making classroom charts, visual schedules, step-by-step instructions for task completion, materials for emerging readers, interactive storybooks, or big books with matching picture cards. The cards also can be used for vocabulary development and in reading comprehension and writing activities, for both whole group and individual learning activities.