DoDEA’s 21st Century Teaching, Learning, and Leading

21st Century Strands & Strategies

Teach, Learn, Lead

DoDEA

Department of Defense Education Activity
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DoDEA’s 21st Century Teaching and Learning Framework provides specific strands and strategies for educators to utilize to ensure that all students acquire 21st Century Skills and the Common Core State Standards. By incorporating a variety of the strands and strategies, educators create learning environments that promote the development of 21st Century Skills in students allowing them to deepen their knowledge of the content in the Common Core State Standards. Using 21st Century strands and strategies, the 21st Century Skills, and the Common Core State Standards teachers engage students in authentic real-world problems, inquiry and exploration, and application of meaningful learning.

Strand and Strategy Defined

A strand is a means through which dynamic, rigorous 21st Century student-centered teaching and learning practices are categorized (AdvancED Glossary of Terms). Each strand has direct connections to the military-connected student. A strand is defined by its categorical type.

The 21st CTLL strand categories are as follows:

- Military Support Strand
- Pedagogical Strands
- Leadership Strand

A strategy is a category of professional learning (AdvancED Glossary of Terms). Educators or educational leaders can select the category they want to learn more about and then select one of the strategies to learn more about the strand and its specific strategies. At least three relevant research-based strategies fall under each strand. Educators and educational leaders will have options as they design learning.
goals based on baseline data specific to their unique teaching and learning environments throughout the world.

Connections to the 21st CTLL Professional Learning Framework (PLF)

The strands and strategies are one of the components of the 21st CTLL Professional Learning Framework. The strands and their respective strategies provide educators professional learning choices and the ability to apply the learning within their classroom. Every strand includes instructional practices that focus on engaging and empowering learners through a student-centered, collaborative approach.

The strands and strategies support DoDEA’s vision to be among the world’s leaders in education, enriching the lives of military-connected students and the communities in which they live. The strands and strategies were specifically designed to support DoDEA’s vision and mission as well as the Community Strategic Plan (CSP). While educators and leaders engage in studying a specific strand, they will be able to make direct connections to critical elements in their schools, such as Continuous School Improvement (CSI), AdvancED, assessments, and standards. The strands are the descriptors of a 21st century school.

The Digital Professional Learning will provide the professional learning that is based on the strand categories and their strategies. Through professional learning, educators will learn new methods to engage and empower learners.

Military Connected Child Strand

Truly understanding the unique needs inherent to our military students and communities around the globe serves as the cornerstone of the 21st Century Professional Learning Framework. Ensuring that each child reaches his or her fullest potential despite the challenges of everyday military life is something each educator and educational leader in DoDEA is committed to. This strand provides educators and leaders with the tools they need in order to fully support each child’s emotional and academic needs.
The strategies under the Military Support strand are:

1. The Child
2. The Family
3. The Community

Pedagogical Strands

The pedagogical strands focus on teaching and learning, and have been designed to set the stage to build a safe, rigorous, risk-free learning environment for all military-connected students. The strands have been carefully crafted to support and promote a student-centered approach to teaching and learning, which strives to ensure that every child meets his or her fullest potential in all content areas. Each of the pedagogical strands has specific strategies that support the strand. Technology is interwoven throughout each of these strands and serves as a strand on its own to support best practices in teaching and learning in the 21st Century.

The pedagogical strands include:

1. The Learning Environment
2. Student Centered Instruction
3. Curriculum Integration
4. Technology Integration

Leadership Strand

One of the six strands focuses on leadership in a 21st Century environment. As collaboration is a critical 21st Century skill, this strand focuses on developing a “shared leadership” approach. While emphasizing collaboration, the leadership strand also offers educational leaders, to include classroom educators, to leadership skills to support and build/develop DoDEA’s mission, to “Educate, Engage, and Empower Each student to succeed in a dynamic world.”

The strategies under the Shared Leadership strand are:

1. Administrative Leadership
2. Teacher Leadership
3. Student Leadership
Strands & Strategies: At-A-Glance

There are six strands or categories of learning, each having a set of skills to be mastered for effective instruction and improved learning outcomes for students. The six strands are: Learning Environment, Student-Centered Instruction, Curriculum Integration, Military-Connected Child, and Shared Leadership.

Learning Environment

The Learning Environment strand includes physical spaces, support systems, and the social-emotional climate, and actively seeks the involvement of all stakeholders within the community, school, and classroom. The environment allows students to reason, solve problems, collaborate with others, and apply technology effectively.

1. Physical Environment: The Physical Environment facilitates teaching and learning through providing equitable access to quality learning tools, technologies, and resources allowing the support and collaboration needed to integrate 21st Century skills into classroom practice.
2. Social-Emotional Environment: When students are supported academically, socially, and emotionally, the classroom environment is more conducive to learning.
3. Academic Environment: Students learn best in an environment that is academically challenging and engaging.
4. Support Systems and Resources: Leveraging a variety of support systems and resources meets individual learning needs and empowers students to become lifelong learners.
5. Data-Driven Decision-Making: Data-driven decision making (DDDM) is "a system of teaching and management practices that gets better information about students into the hands of classroom teachers" (McLeod, 2005). Using student data to better address students' learning needs through instructional decisions at the classroom, district, state, and national levels has potential, when implemented well, to be useful for improving teaching and learning.
6. Differentiated Instruction: Differentiated Instruction is student-centered approach that encompasses positive learning environment, quality curriculum, on-going assessment and data, respectful/challenging tasks, and flexible grouping.
Student Centered Instruction

Student-centered Instruction is the intentional integration of innovative pedagogy which promotes inquiry-based learning through the effective use of differentiation strategies and technology to engage and empower learners. Inquiry-based learning is inherent in all of the student centered strategies. In real inquiry, students follow a trail with their own questions that leads to a search for resources and the discovery of answers which ultimately leads to generating new questions, testing ideas, and drawing their own conclusions. Real innovation is the drive for answers, new products, and solutions to problems.

1. Inquiry-Based Instruction: Inquiry-Based Instruction is an approach to learning that involves a process of exploring the natural, empirical, and material world, which leads to asking many questions, making discoveries, and rigorously testing them in the search for new understanding (Chambers, C. 2002).

2. Project-Based Learning (PBL): Project-Based Learning is “a systematic teaching method that engages students in learning knowledge and skills through an extended inquiry process structured around complex, authentic question and carefully designed products and tasks” (Buck Institute for Education).

3. Problem-Based Learning: “Problem-Based Learning is an instructional (and curricular) learner-centered approach that empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem” (Savery, J. R. 2006).

4. Cooperative Learning: Cooperative Learning is the instructional use of small groups so that students work together to maximize their own and each other’s learning. (Johnson and Johnson, Holubeck, 1998).

5. Flipped Instruction: Flipped Instruction is a model of instruction in which students receive direct instruction outside of class; in order to create time for student centered learning activities with teacher and peer support in order to demonstrate mastery of learning objectives (Bergman, J. and Sams, A. 2012).

6. Blended Learning: Blended Learning has face-to-face interaction, synchronous conversations, asynchronous interactions, as well as constant feedback. Course materials are delivered electronically while at the same time students can email their teachers and participate in chat rooms and threaded discussion forums. Electronic instruction and online learning activities are followed up by face-to-face interaction (U.S. Department of Education. September 2010).
Curriculum Integration

Curriculum Integration is a planned, multidisciplinary approach to instruction that provides relevant and rigorous learning experiences that make connections within and across subjects and within and across learners. Embedded in Common Core State Standards, curriculum integration provides real world opportunities for students to become analytical problem solvers. Rigor is the foundation of curriculum integration as students are able to transfer their learning to real-life situations. The strategies that support curriculum integration are tiered to differentiate across teacher readiness levels to include multidisciplinary, interdisciplinary, and transdisciplinary approaches to learning.

<table>
<thead>
<tr>
<th>Multidisciplinary Integration (least degree of integration)</th>
<th>Interdisciplinary Integration (medium degree of integration)</th>
<th>Transdisciplinary Integration (paradigm shift of integration)</th>
</tr>
</thead>
</table>

1. **Multidisciplinary Integration**: Multidisciplinary Integration approaches focus mainly on the disciplines. Teachers organize standards from the disciplines around a theme. This approach offers teachers a simpler, more efficient way to base instruction on standards in meaningful ways (Meeth, L. R. 2012).

2. **Interdisciplinary Integration**: Interdisciplinary Integration is the organization of curriculum around common learning across the disciplines. It is the attempt in practice to integrate the contributions of several disciplines to one problem, issue or theme from life. Interdisciplinary integration involves relating whole to part, part to whole, and part to part (Meeth, L. R. 2012).

3. **Transdisciplinary Integration**: Transdisciplinary Integration occurs when teachers organize curriculum around student questions or concerns. Students develop life skills as they apply disciplinary and interdisciplinary skills into real-life contexts (Drake and Burns, 2004). Transdisciplinary integration starts with the problem and through problem solving uses the disciplines that contribute to the solution (Meeth, L. R. 2012).

4. **Science, Technology, Engineering, and Mathematics (STEM)**: STEM education is an approach to teaching and learning that integrates the content and skills of science, technology, engineering, and mathematics. DoDEA STEM education is an educational program designed to provide students with opportunities to be successful in the fields of Science, Technology, Engineering, and Mathematics.
Our purpose is to ignite the passion of students to pursue education and careers in STEM disciplines. The three goals of DoDEA STEM education are to:

- Create K-12 student interest, participation, and achievement in higher levels of math, science, and technology through the engineering design process,
- Attract and retain students to STEM fields with a focus on underrepresented and female populations, and
- Support the national security focus on the shortage of STEM professionals.

Technology Integration

Technology integration empowers learners to share self-generated knowledge and make real world connections that reach beyond school walls. Technology provides educators opportunities to utilize innovative and engaging teaching practices, expanded learning communities, and current information.

1. Curriculum: With the appropriate integration of technology with curriculum, students will have access to broad a range and depth of content and resources that are relevant and engaging. A digital environment provides and organizational structure for efficient access to current information from multiple locations.

2. Instruction: The tools of technology enable teachers to design and facilitate instruction that is engaging, responsive, inclusive, and collaborative. As a result, students are involved in real world connections beyond the walls of the classroom, apply 21st century Learner Outcomes to their work, and have access to instruction tailored to their individual learning style.

3. Assessment: The tools of technology assess progress by collecting, analyzing and organizing student information. The immediate feedback can be used by students to promote ownership of learning and provide multiple opportunities for growth. Teachers can use the information compiled and analyzed by technology to inform instructional decisions (differentiated instruction, flexible grouping, readiness, enrichment, etc.) that result in increased student achievement.

4. Integration: Technology integration and communication includes the processes for online communication/production/access both synchronous and asynchronous among all stakeholders.
Military Connected Child

The Military Children are those whose parents serve the nation. In turn, the military connected children face many challenges and special circumstances that are different from those experienced by civilian children and their families. These challenges and circumstances include gaps in school attendance and learning due to frequent moves, families being separated due to parental deployment, and a sense of isolation when they transfer to schools in the midst of a civilian community.

1. The Child: The Military Children are those whose parents serve the nation. In turn, the military connected children face many challenges and special circumstances that are different from those experienced by civilian children and their families. These challenges and circumstances include gaps in school attendance and learning due to frequent moves, families being separated due to parental deployment, and a sense of isolation when they transfer to schools in the midst of a civilian community.

2. The Family: Military family is an all-inclusive term representing the parents and guardians of school-age children of military members.

3. The Community: The greater military community recognizes its role as a support to the families of those who serve and provides many resources to that end. Local installations offer a variety of resources to which our military families and their students are able to access.

Shared Leadership

The Leadership Strand focuses on school leadership, transformational leadership through shared leadership model. Leaders who build their school culture around shared leadership develop strong ownership of the work, collaboration, strong relationships, and ownership of the results of the work. The Leadership Strand supports the various roles of the 21st century roles of leaders in the school; principals, teachers, and students.
1. **Administrative Leadership:** 21st Century administrators transform the educational community through a powerful and dynamic presence that promotes continuous school improvement, effective professional practice, and digital age learning and citizenship.

2. **Teacher Leadership:** Teacher leaders are embedded into the school site through teaching in classrooms, serving as instructional coaches, and fostering change through the CSI process. The role of the teacher leader is to enhance student achievement through promoting effective teaching practices in all classrooms and contributing to collective leadership in the building.

3. **Student Leadership:** Students act as leaders in the classroom by demonstrating competency in using and applying tools to process, organize, and analyze information. They work collaboratively with peers and teachers to support and empower others to use the tools successfully.
Strands & Strategies: Deep Dive

Click the links below to learn more about the strands and their corresponding strategies.

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<tr>
<th>Strands &amp; Strategies</th>
<th>Learning Environment</th>
<th>Student Centered Instruction</th>
<th>Curriculum Integration</th>
<th>Technology Integration</th>
<th>Military Connected Child</th>
<th>Shared Leadership</th>
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<td>Social-Emotional Climate</td>
<td>Project-Based Learning</td>
<td>Interdisciplinary Integration</td>
<td>Instruction</td>
<td>The Child</td>
<td>Administrators as Leaders</td>
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<td>Academic Learning Environment</td>
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<td>Assessment</td>
<td>The Family</td>
<td>Teachers as Leaders</td>
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<td>Support Systems and Resources</td>
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<td>Data-Driven Decision-Making</td>
<td>Flipped Instruction</td>
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<td>The Community</td>
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The Learning Environment Strand

The Learning Environment strand includes physical spaces, support systems, and the social-emotional climate, and actively seeks the involvement of all stakeholders within the community, school, and classroom.

The environment allows students to reason, solve problems, collaborate with others, and apply technology effectively.

The purpose is to understand and to utilize physical space, relationships, and academic rigor to increase student learning and their association of learning to the spaces and people around them.

Big Ideas

- When students are supported academically, socially, and emotionally, the classroom environment is more conducive to learning.
- Students learn best in an environment that is academically challenging and engaging.
- Design a physical learning environment that supports 21st Century teaching and learning.
- Leveraging a variety of support systems and resources meets individual learning needs and empowers students to become lifelong learners.

Looks Like/Sounds Like

- Students and teachers working in collaborative small groups
- Flexible groups that change regularly
Students accessing resources other than the teacher
Teacher as facilitator
Students using a variety of technology to facilitate their learning
Student sitting in groups/communities
Technology access throughout room
Every student engaged
Students discussing, debating, and questioning
Teacher talking with small groups
Students leading self-directed small group activities
Students talking to a partner
Teachers collaborating with teachers

The Learning Environment Strategies

Physical Learning Environment

The physical learning environment facilitates teaching and learning through providing equitable access to quality learning tools, technologies, and resources allowing the support and collaboration needed to integrate 21st Century skills into classroom practice.

In the video below, Architect Trung Le from OWPP//Cannon Design in Chicago talks about North Shore Country Day School, a 21st Century high school outside of Chicago, Illinois. This video was produced by North Shore Country Day School.
Connections

- 21st Century learning environment provides opportunities for student-centered instruction in a variety of educational settings including whole group, flexible small groups, and independent learning arrangements
- Interactions between the learner and the environment
- Responsive learning: a culture of inquisitiveness
- Learner engaged in self-directed or cooperative activities
- Inquiry-based learning
- Technology integration throughout all phases of learning

Social-Emotional Learning Environment

When students are supported academically, socially, and emotionally, the classroom environment is more conducive to learning. When children learn in an environment where they are expected to work in teams or in small groups they must collaborate throughout the process continually.

Studies show that sustained and well-integrated social and emotional learning (SEL) programs can help schools engage their students and improve achievement. Watch the video below to explore the classroom practices that make up the best and most effective SEL programs.

Source: 5 Keys to Social and Emotional Learning Success uploaded on YouTube by Edutopia

Connections

The whole child and academics is important to develop: self-awareness, self-management, social awareness, relationship skills, decision-making skills
21st Century Strands & Strategies

- Collaborate, communicate, resolve conflicts
- Character development
- Conflict resolution

Academic Learning Environment
Students learn best in an environment that is academically challenging and engaging. In the video, which was shot in schools in 9 countries, Learning Activist and 21 Foundation founder Patrick Newell highlights 21st Century teaching and learning practices such as collaboration, curriculum integration, technology integration, and guided inquiry all of which contribute to a strong academic, risk-free learning environment.


Connections

- 21st Century skills and competencies for the 21st Century economics and social development
- Social network environments
- Common Core State Standards and 21st Century skills taught in tandem
- Collaboration in learning
- Technology Integration: students using tools interactively in the learning process
- Curriculum integration: students actively engaged in cross curricular learning to deepen knowledge and understand its application in the real world
- Reading and Math literacies
Support Systems and Resources

Leveraging a variety of support systems and resources meets individual learning needs and empowers students to become lifelong learners.

Watch the video below to hear Mimi Ito, an expert in young people's use of digital media, share her research on informal learning in online communities, where students can build technology skills, learn media literacy, and create and share their work.

Source: Mimi Ito on Learning in Social Media Spaces (Big Thinkers Series) uploaded on YouTube by Edutopia

Connections

- 21st Century Learner Outcomes
- Technology Integration
- Curriculum and 21st Century Learner Outcomes
- Digital Literacy Skills: Media, Information, Technology, Communication
- Social interactions and networking
Data-Driven Decision-Making

Data-driven decision making (DDDM) is "a system of teaching and management practices that gets better information about students into the hands of classroom teachers" (McLeod, 2005). Using student data to better address students' learning needs through instructional decisions at the classroom, district, state, and national levels has potential, when implemented well, to be useful for improving teaching and learning.

"Information is the key to holding schools accountable for improved performance every year among every student group. Data is our best management tool. I often say that what gets measured, gets done. If we know the contours of the problem, and who is affected, we can put forward a solution. Teachers can adjust lesson plans. Administrators can evaluate curricula. Data can inform decision-making."

- Margaret Spellings, U. S. Secretary of Education (January 20, 2005 – January 20, 2009)

According to Bernhardt, to move toward a data-driven decision making school, there are eight steps that help guide the process (2004). The eight-step process is as follows:

1) Develop a leadership team
2) Collect and organize several different types of data
3) Analyze data patterns
4) Generate hypotheses
5) Develop goal-setting guidelines
6) Design specific strategies for the action plan
7) Plan the evaluation
8) Implement the plan

By following the steps listed, a school can collaborate and prioritize needs in order to sustain a vision that focuses on school improvement (NC REL, 2004).

Connections

- There are various types of data that inform district, school and the classroom (multilayered-attendance; formative, benchmark, formative assessment, program, behavior, cohort data, and professional development).
- Data must be systemically and consistently used to impact student achievement.
Top 10 Uses of Data in Schools:

1. Data can uncover problems that might otherwise remain invisible.
2. Data can convince people of the need for change.
3. Data can confirm or discredit assumptions about students and school practices.
4. Data can get to the root cause of problems, pinpoint areas where change is most needed, and guide resource allocation.
5. Data can help schools evaluate program effectiveness and keep the focus on student learning results.
6. Data can provide feedback that teachers and administrators need to keep going and stay on course.
7. Data can prevent over-reliance on standardized tests.
8. Data can prevent one-size-fits-all and quick solutions.
9. Data can give schools the ability to respond to accountability questions.
10. Data can build a culture of inquiry and continuous improvement.

Attributes of Districts that Make Wise Use of Data:

<table>
<thead>
<tr>
<th>Strong Leadership</th>
<th>Supportive Learning Environment</th>
<th>Well-defined Data Driven School Improvement process</th>
<th>Wise Use of Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong leadership: All administrators are committed to collecting and using data for decision making and improving teaching and learning.</td>
<td>A supportive district-wide culture for using data for continuous improvement: Data is not used as a “stick.” It is made available to all students, teachers, administrators, and parents to review and use to make improvements.</td>
<td>A well-defined, data-driven school improvement process: Schools use data to identify problems, create action plans to address problems, and monitor the implementation and results to see how well the plan works. The results are fed back into the next cycle for improvement planning.</td>
<td>Wise Use of Data</td>
</tr>
</tbody>
</table>
Data-Driven Decision Making is an integral part of:

- DoDEA’s Community Strategic Plan (CSP)
- AdvancEd Continuous School Improvement (CSI)
- Differentiation of Instruction (DI)
- Professional Learning Communities (PLCs)
- 21st Century Professional Learning Framework (PLF)

**ORID: Focused Conversation Data Analysis**

The ORID protocol is one way schools can analyze data. It is a FOCUSED conversation about data, and includes the following four modes of thinking: Objective, Reflective, Interpretive, and decisional. The files below can be used by administrators with staff to conduct a focused conversation about SAT data:

- [ORID Power Point Presentation](#)
- [ORID Graphic Organizer](#)
- [SAT Data Discussion](#)

This video from the Data Quality Campaign answers the question "Who Uses Student Data?" There are a lot of different answers!

Source: Who Uses Student Data? Uploaded on YouTube by Data Quality Campaign

Click the link, [CoSN Data-Driven Decision Making](#) to learn about how to turn data into action!
Differentiated Instruction

Differentiation is a teacher’s response to students’ needs, guided by general principles of differentiation such as respectful tasks, flexible grouping and on-going assessment and adjustment. “Differentiated Instruction is responsive teaching rather than one size fits all teaching. To increase student achievement, educators proactively plan varied approaches aligned to what students need to learn, how they will learn, and how they will show what they have learned.”

Watch the video below to see how a new teacher uses differentiated instruction to engage her students in a chemistry lesson.

Source: The TeachingChannel (Tch)

The Five Tenets of Differentiated Instruction differentiated instruction help teachers focus, “accept and build upon the promise that learners differ in important ways” (Tomlinson, The Differentiated Learner, 2004, p. 2). These five tenets, along with the way teachers adjust content, process and product in response to student readiness, interest and learning profile are the foundational pieces of a differentiated classroom.
The Tenets include:

1. **Invigorating Learning Environments Maximize Each Student’s Growth and Individual Success.**

   Learning environments ignite the interests and passion of students to learn, and they are communities where individual differences are honored and foundational to the teaching and learning experience. Invigorating learning environments are student-centered and characterized by individual and collaborative learning, active student participation in learning, and a focus on student interests and needs. They encourage positive social interaction and self-motivation. They differentiate instruction – all of the time.

2. **On-going Assessment and Data of Student Readiness, Interests and Needs Are Essential Instructional Tools.**

   Student performance data and ongoing assessments are used to plan, direct and differentiate instruction. Continuous assessment engages learners in their own growth; provides students with specific information about their performance in a way that helps them improve; monitors learners’ progress; and guides teacher and learner decision making.

3. **Learning Tasks Are Respectful, Challenging, Inviting, and Thought-Provoking for All Students.**

   Students exposed to engaging work develop and deepen their understanding of content, build their critical and creative thinking competencies, and have more meaningful learning experiences. In differentiated classrooms, instruction is designed to provide all students stimulating and challenging tasks and abundant opportunities to demonstrate their learning in different ways. Students in these classrooms become active and responsive explorers. Student learning experiences meeting the yardstick of this tenant allow all students the opportunity to flourish and succeed.

4. **Access to High Quality Curriculum Deepens Learning.** Curriculum, instructional materials, differentiated instruction, and teacher and student behaviors all combine to make content accessible for all students.

   This tenant relies upon disciplined and deliberate articulation of what we want students to know and be able to do, how we know when they have learned, what we will do when they have not learned, and what we will do when they have exceeded the learning expectations. There is an obvious line-of-sight from the student tasks and objectives to the content standards and learning goals. There are explicit goals in lesson designs that apply content knowledge to real-world problems, connect concepts, use differing perspectives, and encourage critical and creative thinking and collaborative problem-solving. Students are challenged -- all of the time.
Flexible Grouping is consistently used to drive and deepen student growth and achievement.

Learners are expected to interact and work together as they develop knowledge of new content. As one of the foundations of differentiated instruction, intentional grouping and regrouping must be a dynamic process, changing the content, project and on-going assessments to meet the diverse student needs. Groups of students are not fixed. Teachers may conduct whole-class discussions of content big ideas followed by small group or paired work. Student groups are coached from within the group of by the teacher to complete assignments. Appropriate instructional strategies and resources are used to flex instruction to the needs of individual and groups of learners.

Connections

Based on a teacher’s understanding of their students’ readiness, ability and learner profile, they can adjust three key elements of any curriculum: content, process and product.

<table>
<thead>
<tr>
<th><strong>Content</strong></th>
<th><strong>Process</strong></th>
<th><strong>Product</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Content refers to what the teacher wants the student to learn and the materials or mechanisms through which that is accomplished (Tomlinson, 1999, p. 11). Simply put, this is what students learn.</td>
<td>Process refers to the activities designed to ensure that students use key skills to make sense out of essential ideas and information (Tomlinson, 1999, p. 11). Process also refers to how a student makes sense of, or comes to understand, the information, ideas, and skills that are at the heart of a lesson (Tomlinson, 2003, p. 5). Simply put, this is how students learn.</td>
<td>Product refers to the vehicle through which students demonstrate and extend what they have learned (Tomlinson, 1999, p. 11). Product refers to assessments or demonstrations of what students have come to know, understand, and be able to do as the result of an extended sequence of learning (Tomlinson, 2003, p. 5). Simply put, this is how students share what they know.</td>
</tr>
</tbody>
</table>

As teachers discover the readiness level, interest, and learning profile for each of their students, they tailor the five tenets of differentiated instruction to meet the needs of the whole child.

| Readiness Level | Interest | Product |
### Readiness
Readiness is “a student’s entry point relative to a particular interest or skill.” Assessing readiness differs from ability grouping in that readiness strategies are used prior to beginning each unit, as well as through the unit. Therefore, a student may be at a higher level of readiness in one skill area, such as interpersonal communication, and a lower level of readiness in another, such as accessing information. Based on readiness results, the teacher can determine a strategy for supporting each student’s learning needs relative to the content and skills being taught. Readiness assessments can also be used as a unit of study progresses, check to continue the appropriate differentiation of instruction.

### Interest
Interest is a student’s “affinity, curiosity or passion for a particular topic or skill” (Tomlinson, 1999, p. 11). Knowing the various interests of students helps teachers create the “hook” necessary to engage their students in new content and skills. For example, a reluctant math learner who likes sports might be enticed into learning about statistics in the context of sports scores. Attaching meaning to learning for students helps to prevent the age-old question of “how does this relate to real life?” Consequently, it yields better mastery of concepts and skills among all students. The interest of each student can be determined in a variety of ways including regular dialogue, assignments that ask students to discuss their interests, and formal inventories that measure interests.

### Learning Profile
Learning Profile outlines how a student learns (Tomlinson, 1999). Learning profiles are developed by assessing how, and under what conditions, students learn best. Many factors influence a person’s learning profile, however according to Tomlinson (2003), research supports the following four key areas: learning style, intelligence preference (this refers to preferences within the context of Howard Gardner’s Multiple Intelligence model), gender, and culture. Determining a student’s learning profile helps the teacher create an environment that allows for student differences and sets the stage for differentiation of content, product and/or process.

To build a differentiated classroom focused on a positive environment, it is important teachers recognize that “from the moment a student enters a classroom, the teacher is communicating, both overtly and covertly, the value he/she places on learning and the degree of acceptance of students as individuals. The walls and artifacts chosen by the teacher can communicate a warm welcome or dull acceptance of responsibility.” (2003, p. 37).
Education doesn’t work with a one-size-fits-all approach. Teaching requires a deep understanding of the differences— in knowledge, abilities, and learning styles— that students bring to class. Differentiated instruction is the umbrella term describing the many ways that teachers modify their curriculum to meet the needs of all their students.

Examples of Instructional and Management Strategies Teachers Use to Differentiate:

<table>
<thead>
<tr>
<th>Multiple Intelligences</th>
<th>Tiered Lessons</th>
<th>Varied Questioning Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jigsaw</td>
<td>Tiered centers</td>
<td>Interest centers</td>
</tr>
<tr>
<td>Taped material</td>
<td>Tiered products</td>
<td>Interest groups</td>
</tr>
<tr>
<td>Anchor activities</td>
<td>Learning contracts</td>
<td>Varied homework</td>
</tr>
<tr>
<td>Varying organizers</td>
<td>Small group instruction</td>
<td>Compacting</td>
</tr>
<tr>
<td>Varied texts</td>
<td>Group investigation</td>
<td>Varied homework</td>
</tr>
<tr>
<td>Varied supplementary materials</td>
<td>Literature circles</td>
<td>Varied journal prompts</td>
</tr>
<tr>
<td>Independent study</td>
<td>Guided reading</td>
<td>Complex instruction</td>
</tr>
</tbody>
</table>

Watch the video below to see how game designers at Mangahigh use gaming technology to engage and challenge each student in solving real-world math problems. Click the link, Mixing it Up with Mangahigh: Using Games to Differentiate Instruction from Edutopia to learn more.

Source: Online Math Games Balance Challenge with Mastery Learning uploaded on YouTube by Edutopia
Student Centered Instruction Strand

Student Centered Instruction is the intentional integration of innovative pedagogy which promotes inquiry-based learning through the effective use of differentiation strategies and technology to engage and empower learners. Inquiry-based learning is inherent in all of the student centered strategies. In real inquiry, students follow a trail with their own questions that leads to a search for resources and the discovery of answers which ultimately leads to generating new questions, testing ideas, and drawing their own conclusions. Real innovation is the drive for answers, new products, and solutions to problems.

Big Ideas

“The tenets of a student-centered approach are:

- Focus on active rather than passive learning,
- Emphasis on deep learning and understanding,
- Increase responsibility and accountability on the part of the student,
- Increase sense of autonomy in the learner,
- Increase interdependence between teacher and learner,
- Develop mutual respect within the learner-teacher relationship, and
- Focus on a reflexive approach to the teaching and learning process on the part of both teacher and learner.”

21st Century Strands & Strategies

Looks Like

- Students working in collaborative small group
- Flexible groups that change regularly
- Students accessing resources other than the teacher
- Teacher as facilitator
- Students using a variety of technology to facilitate their learning
- Students sitting in groups/communities
- Technology stations throughout the room
- Every student engaged

Sounds Like

- Students discussing, debating, and questioning
- Teacher talking with small groups
- Students leading self-directed small group activities
- Students talking to a partner

Student Centered Instruction Strategies

Inquiry-Based Learning

Inquiry is a dynamic process of being open to wonder and puzzlement and coming to know and understand the world. Inquiry is based on the belief that understanding is constructed in the process of people working and conversing together as they pose and solve the problems; make discoveries and rigorously testing the discoveries that arise in the course of shared activity.

Inquiry is a study into a worthy question, issue, problem or idea. It is the authentic, real work that that someone in the community might tackle. It is the type of work that those working in the disciplines actually undertake to create or build knowledge. Therefore, inquiry involves serious engagement and investigation and the active creation and testing of new knowledge (Wells, G., 2001).
Inquiry-Based Instruction is an approach to learning that involves a process of exploring the natural, empirical, and material world, which leads to asking many questions, making discoveries, and rigorously testing them in the search for new understanding (Chambers, C., 2002).

In the video below, Professor Jo Boaler works with secondary school students in the InQbate at the University of Sussex using Inquiry-Based Learning methods for mathematics. Watch the video to see inquiry-based learning in action with student.

Source: Jo Boaler - Enquiry Based Learning for Mathematics uploaded on YouTube by Kelly Burks

Connections

- Student learning is addressed through the following:
- Student involvement in real-life problems and scenarios in flexible groups
- Student utilizing a wide-variety of research and resources
- Engaging in student-centered instruction
- Integrating STEM
- Teacher use of higher level relevant questions for application and synthesis
- Teacher roles evolve from teacher-centered to student-centered to include facilitation, student mentoring, and differentiating instruction for individual learners

5E Instructional Model

Introduction

The 5E Instructional Model is not a recipe for teacher practice but rather a framework to inform conversations and guide the observation, critique and reflection of classroom
practice. There are many different ways that teachers can vary in their approach and their behavior and still be highly effective in the classroom.

All teachers use their professional judgment to adapt their practice to the specific context in which they work and to the particular cohort of students they teach. However, within this zone of discretion there are common practices required as a professional knowledge base for teachers to improve their practice of the 5 E model. The video below provides the basics of the 5E model to develop that professional knowledge.

**Engage**

During the Engage stage, the teacher assesses previous knowledge of students and helps them become engaged in a new concept through the use of short activities that promote curiosity and elicit prior knowledge. The goal is to organize students' thinking toward the learning outcomes of the new concept.
Teachers' Role

The teacher fosters positive relations with and between students and develops shared expectations for learning and interacting. The teacher stimulates interest and curiosity, promotes questioning and connects learning to real-world experiences. The teacher structures tasks, elicits students' prior knowledge and supports students to make connections to past learning experiences. The teacher presents a clear purpose for learning, determining challenging learning goals and making assessment and performance requirements clear. The teacher assists students to consider and identify processes that will support the achievement of specific learning goals.

Explore

During the Explore stage, students will be involved in a variety of experiences. These experiences may involve observing events or objects, manipulating materials, working with simulations, examining representations, viewing a short video, or reading.

These experiences provide a common basis for all students that the teacher can use to assist students in identifying and developing concepts and skills.

Teacher's Role

The teacher presents challenging tasks to support each student in generating and investigating questions, gathering relevant information and developing ideas. The teacher provides tools, resources, and procedures that will guide students as they organize information and ideas. The teacher identifies students' conceptions and challenges misconceptions. The teacher assists students in expanding their perspectives and reflecting on their learning. The teacher is mindful of the learning requirements of the task, attentive to student responses and intervenes accordingly.
Explain

During the Explain stage, students begin to communicate what they have learned. The purpose of the Explain stage is to provide students with an opportunity to communicate what they have learned so far and figure out what it means. Language provides motivation for sequencing events into a logical format. Communication occurs between peers, with the teacher who functions as a facilitator, and through the reflective process.

Teacher's Role

The teacher provides opportunities for students to demonstrate their current level of understanding through verbal and non-verbal means. The teacher explicitly conveys relevant knowledge, concepts and skills. This content is represented in multiple ways. The teacher provides specific strategies encouraging students to connect and organize new as well as existing knowledge. The teacher assists students in representing their ideas, using language and images that engage students in reading, writing, speaking, listening and viewing. The teacher explicitly communicates the language of the discipline. The teacher increasingly assesses students' understanding and structures opportunities for students to practice new skills.

Expand | Extend | Elaborate

The next phase challenges students to extend their understandings or skills and/or to practice them. Through new experiences at this time, students develop deeper understanding, an extended conceptual framework, and improved skills.

Teacher's Role

The teacher engages students in dialogue, continuously extending and refining students' understanding. The teacher supports students as they identify and define relationships between concepts and as they generate principles or rules. The teacher selects contexts from familiar to unfamiliar, which increasingly builds students' ability to transfer and generalize their learning. The
teacher supports students to create and test hypotheses and to make and justify decisions. The teacher monitors students' understanding, providing explicit feedback, and adjusting instruction accordingly.

Evaluate

The final phase of the 5E Instructional Model is the Evaluation stage. During the Evaluation stage, the teacher evaluates students' progress toward achieving specific learning objectives for the activity. In addition, students are encouraged to assess their own understanding and abilities in relation to the objective(s) of the activity. The tasks may involve writing summaries, applying concepts and skills to novel situations, constructing a concept map, or taking a quiz.

Teacher's Role

The teacher supports students to continuously refine and improve their work using assessment criteria in preparation for a performance of understanding. They integrate evidence from each phase, formally recording students' progress against learning goals. The teacher provides feedback and assists students to evaluate their progress and achievements. They support students to reflect on their learning processes and the impact of effort on achievement. The teacher guides students to identify future learning goals.

Additional Resources

Please explore the links below to extend your knowledge in using the 5E Instructional Model.

- **Similar Solids and Proportional Reasoning from Mathematics Enhanced Scope and Sequence – Geometry.** Virginia Department of Education.
- **5E Lesson Plan in Mathematics** from WikiEducator.
- **A proposed 7E model emphasizes “transfer of learning” and the importance of eliciting prior understanding.** Expanding the 5E Model from the National Science Teachers Association (NSTA).
Project-Based Learning

Project-Based Learning (PBL) is "a systematic teaching method that engages students in learning knowledge and skills through an extended inquiry process structured around complex, authentic questions and carefully designed products and tasks" (Buck Institute for Education).

The video below combines fresh animation and lively presentation by Sam Seidel, author of the book Hip Hop Genius, about the need to "keep it real" in school with PBL. Drawings from his work at High School for the Recording Arts (HSRA) features an original song from a student's science project to make the case for powerful authentic learning.

Source: Keep It Real uploaded on YouTube by BIE

Connections

- Respectful and challenging tasks involve students in voice and choice
- Flexible grouping provides students multiple ways to work and learn from each other
- Differentiation occurs through the process and products students develop

What does the research suggest?

Studies have proven that when implemented well, project-based learning (PBL) can increase retention of content and improve students' attitudes towards learning, among other benefits.
21st Century Strands & Strategies

Project-based learning is derived from a tradition of pedagogy which asserts that students learn best by experiencing and solving real-world problems. According to researchers (Barron & Darling-Hammond, 2008; Thomas, 2000), project-based learning essentially involves the following:

- students learning knowledge to tackle realistic problems as they would be solved in the real world
- increased student control over his or her learning
- teachers serving as coaches and facilitators of inquiry and reflection
- students (usually, but not always) working in pairs or groups

Studies comparing learning outcomes for students taught via project-based learning versus traditional instruction show that when implemented well, PBL increases long-term retention of content, helps students perform as well as or better than traditional learners in high-stakes tests, improves problem-solving and collaboration skills, and improves students' attitudes towards learning (Strobel & van Barneveld, 2009; Walker & Leary, 2009). PBL can also provide an effective model for whole-school reform (National Clearinghouse for Comprehensive School Reform, 2004; Newmann & Wehlage, 1995).

What is the difference between Project-Based Learning and Problem-Based Learning?

The term "project learning" derives from the work of John Dewey and dates back to William Kilpatrick, who first used the term in 1918. A major emphasis of Project-Based Learning involves an extended project. According to the Buck Institute for Education (BIE), Project-Based Learning will take several forms or be a combination of the following:

- Designing and/or creating a tangible product, performance or event
- Solving a real-world problem (may be simulated or fully authentic)
- Investigating a topic or issue to develop an answer to an open-ended question
BIE commissioned Common Craft to create a short animated video that explains the essential elements of Project Based Learning (PBL). This simple video makes the essential elements of PBL come alive and brings to light the 21st Century skills and competencies (collaboration, communication, critical thinking) that will enable K-12 students to be college and career ready as well as effective members of their communities.

Source: Project Based Learning: Explained uploaded on YouTube by BIE

Problem-Based Learning as a teaching strategy and curricular design began over thirty years ago at McMaster University in Canada. Using problems based on actual clinical cases as focal points in a medical program evolved after years of medical faculty and student frustration with the traditional lectures and challenging clinical experiences. Thus, Problem-Based Learning involves case studies and simulations presented as "problems." It is more common in the post-secondary educational setting.

Problem-Based Learning adheres to the following recommended steps:

1. Presentation of an "ill-structured" (open-ended, "messy") problem
2. Problem definition or formulation (the problem statement)
3. Generation of a “knowledge inventory” (a list of “what we know about the problem” and “what we need to know”)
4. Generation of possible solutions
5. Formulation of learning issues for self-directed and coached learning
6. Sharing of findings and solutions

Similarities & differences between Project-Based Learning and Problem-Based Learning

Similarities

- Focus on an open-ended question or task
- Provide authentic applications of content and skills
- Build 21st Century skills
- Emphasize student independence and inquiry
- Are longer and more multifaceted than traditional lessons or assignments
- Student-focused, rather than teacher-focused

Differences

<table>
<thead>
<tr>
<th>Project-Based Learning</th>
<th>Problem-Based Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Often multi-disciplinary</td>
<td>More often single-subject</td>
</tr>
<tr>
<td>May be lengthy (weeks or months)</td>
<td>Tend to be shorter</td>
</tr>
<tr>
<td>Follows general, variously-named steps</td>
<td>Follows specific, traditionally prescribed steps</td>
</tr>
<tr>
<td>Includes the creation of a product or performance</td>
<td>The “product” may simply be a proposed solution, expressed in writing or in an oral presentation</td>
</tr>
<tr>
<td>Often involves real-world, fully authentic tasks and setting</td>
<td>More often uses case studies or fictitious scenarios as “ill-structured problems”</td>
</tr>
</tbody>
</table>

Problem-Based Learning

Problem-Based Learning encompasses realistic and authentic ill-structured problems, where students are actively engaged in critical and creative ways of thinking to solve the problem. Effective collaboration and communication are essential ways of working in a 21st Century instructional environment.
“Problem-Based Learning is an instructional (and curricular) learner-centered approach that empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem” (Savery, J. R., 2006. Overview of Problem-based Learning: Definitions and Distinctions).

Problem-Based Learning in a classroom is students actively working together to solve a real-world problem. Ultimately, students learn content through actively engaging in an investigative process for finding the solution(s) to a specific problem. In the video below, you will see interviews of teachers and administrators discussing the benefits of Problem-Based Learning.

Source: Reinventing a Public High School with Problem-Based Learning uploaded on YouTube by Edutopia

Connections

Student learning is addressed through the following:

- Providing students with respectful and challenging tasks
- Being members of flexible groupings
- Having their learning styles and interests addressed through various problems and topics
- Having various learning modalities
• Engaging in student-centered instruction
• Incorporating 21st century skills to find solutions to real world problems to find for solutions
• Integrating STEM

What does the research suggest?

“Research studies have demonstrated that Problem-Based Learning can:

• be more effective than traditional instruction in increasing academic achievement on annual state-administered assessment tests.
• be more effective than traditional instruction for teaching mathematics, economics, science, social science, clinical medical skills and for careers in the allied health occupations and teaching.
• be more effective than traditional instruction for long-term retention, skill development and satisfaction of students and teachers.
• be more effective than traditional instruction for preparing students to integrate and explain concepts.
• improve students’ mastery of 21st century skills.
• be especially effective with lower-achieving students.”

Source: Buck Institute for Education (BIE)
Cooperative Learning

Cooperative Learning is the instructional use of small groups so that students work together to maximize their own and each other's learning. (Johnson and Johnson, Holubeck, 1998).

It's extremely common for teachers to require students to work in groups. However, certain types of groups and activities are preferred over others. In the video below, you will hear a definition of cooperative learning, its advantages in the classroom, and how it is different from collaborative learning.

Source: Cooperative & Collaborative Learning in the Classroom uploaded on Education Portal

Connections

- Develop and use critical thinking skills and teamwork;
- Promote positive relations among different ethnic groups;
- Implement peer coaching; and
- Establish environments where academic accomplishments are valued.

What Does the Research Say?

“More than 70 major studies--by federally sponsored research centers, field-initiated investigations, and local districts examining their own practices--have demonstrated cooperative learning's effectiveness on a range of outcomes:
• Student achievement: When two necessary key elements—group goals and individual accountability—are used together, the effects on achievement are consistently positive.

• Improved relations among different ethnic groups: One of the earliest and strongest findings shows that students who cooperate with each other like each other.

• Mainstreaming students with learning disabilities: Significant improvements in relationships occur between these students and other children in their class when these learning strategies are used."

Source: Office of Research, Office of Educational Research and Improvement (OERI) of the U.S. Department of Education

In the video below, you will hear Instructors at Patrick Henry Community College in Martinsville, Virginia talk about Cooperative Learning. (Southern Center for Active Learning Excellence)

Source: Cooperative Learning in Action uploaded on YouTube by Mark Nelson

Further Exploration

The links below provide a clear definition of cooperative learning and how it is different than typical small group work, tips for structuring cooperative learning activities to promote student achievement, and researched-based strategies for teachers to apply when using cooperative learning in the classroom.

University of Missouri eThemes: Teaching Tips: Cooperative Learning Strategies
Read articles that define and explain how to use cooperative learning strategies in the classroom. Includes cooperative learning lesson plans for a variety of subjects and grade levels and video demonstrations of various cooperative learning techniques. There are links to eThemes Resources Teaching Tips: Cooperative Learning for High School, Teaching Tips: Cooperative Problem Solving Tasks, and Teaching Tips: Team Building Activities for Elementary Students.

**Context Institute: Cooperative Learning**

This article provides research that supports cooperative learning for student success, and tips for structuring for cooperative interaction in small learning groups.

**Teacher Vision: Cooperative Learning**

This website defines cooperative learning and provides five basic elements that allow successful cooperative learning to occur.
Flipped Instruction

Flipped Instruction is a model of instruction in which students receive direct instruction outside of class in order to create time for student centered learning activities with teacher and peer support in the classroom to demonstrate mastery of learning objectives. (Bergman, J. and Sams, A., 2012). Please click here to learn more about Flipped Instruction from Edutopia!

Source: The Flipped Classroom uploaded on YouTube by Flipped Learning

Connections

- **Content**: Content can be delivered asynchronously, and different content can be assigned to students based on what is needed.
- **Process**: Students need different learning activities to master each standard. Additional class time can be created through flipped instructions can be used to meet the needs of each student.
- **Product**: Various assignments can be used to show mastery of the same content. This variation provides multiple ways students demonstrate learning in meaningful ways.
- **Teachers**: Teachers are able to use a variety of instructional strategies to interact with students every day to meet their learning needs.
- **Asynchronous instruction**: Asynchronous instruction and student guided pacing leads to flexible grouping within the classroom.
- **Frequent assessments**: Frequent assessments allow students and teachers to monitor progress.
**Blended Learning**

Blended Learning Instruction has face-to-face interaction, synchronous conversations, asynchronous interactions, as well as constant feedback. Course materials are delivered electronically while at the same time students can email their teachers and participate in chatrooms and threaded discussion forums. Electronic instruction and online learning activities are followed up by face-to-face interaction (U.S. Department of Education 2010).

Source: Blended Learning in Plain English uploaded on YouTube by the LearningHood

**Connections**

Students benefit from the blended learning approach through the following:

- The evolving pedagogy in which the teacher’s roles include facilitation, student mentoring, and differentiating instruction for individual learners.
- The increased flexibility and personalization of student’s learning experiences.
- The strategic use of technology as districts taps the capabilities of the learning management systems to support a wider range of instructional programs.
- The technology allows ongoing assessment and data collection to be easy and in real time.
- The teacher’s decision about which content, activity, and learning environment would best serve the needs of students - face-to-face or online.
Watch the video below to learn more about Blended Learning and how this strategy transforms instruction.

Source: What is Blended Learning? Provided by the Clayton Christensen Institute on Vimeo

Models of Blended Learning

According to the Clayton Christensen Institute, the definition of blended learning is a formal education program in which a student learns:

1. at least in part through online learning, with some element of student control over time, place, path, and/or pace;
2. at least in part in a supervised brick-and-mortar location away from home;
3. and the modalities along each student’s learning path within a course or subject are connected to provide an integrated learning experience.

(Source: Blended Learning Model Definitions, Clayton Christensen Institute)
Watch the video below to learn about four blended learning models.

Source: The Basics of Blended Learning uploaded on YouTube by Education Elements

Delve Deeper

The Clayton Christensen Institute: This website contains white papers and videos about blended learning.

Blended Learning Model Definitions: Here you will see an introduction of the four models of blended learning: Rotation, Flex, A La Carte, and Enriched Virtual. The Rotation model includes four sub-models: Station Rotation, Lab Rotation, Flipped Classroom, and Individual Rotation from the Clayton Christensen Institute. Click the link to see an excellent diagram of the four models.

"Is K-12 Blended Learning Disruptive? An introduction of the theory of hybrids" This white paper from the Clayton Christensen Institute analyzes blended learning through the lens of disruptive innovation theory to help people anticipate and plan for the likely effects of blended learning on the classrooms of today and schools of tomorrow. The white paper includes the following sections: Introduction to sustaining and disruptive innovation, Hybrid models of blended learning, and Seeing what’s next with blended learning.
Curriculum Integration Strand

Curriculum Integration is a planned, multidisciplinary approach to instruction that provides relevant and rigorous learning experiences that make connections within and across subjects and within and across learners.

Embedded in Common Core State Standards, curriculum integration provides real-world opportunities for students to become analytical problem solvers. Rigor is the foundation of curriculum integration as students are able to transfer their learning to real-life situations.

The strategies that support curriculum integration are tiered to differentiate across teacher readiness levels to include multidisciplinary, interdisciplinary, and transdisciplinary approaches to learning. Click the link to learn more about Curriculum Integration from ASCD.
### Multidisciplinary Integration
(least degree of integration)

- [Image]

### Interdisciplinary Integration
(medium degree of integration)

- [Image]

### Transdisciplinary Integration
(paradigm shift of integration)

- [Image]

#### Big Ideas
- Active classroom
- Student-centered, with teacher-directed but not teacher-centered
- Relevance of curriculum and learning
- Meaningful and authentic learning experiences
- Relevance across subject areas to develop deeper connections and understanding
- Performance-based tasks and assessments
- Solving complex issues
- Teamwork, leadership, collaboration, respect, cooperation
- 21st Century learning outcomes and skills through problem or scenario based learning
Watch the video below to hear a detailed explanation of the Curriculum Integration strand. The video was created by Ms. Elise Rosch, Instructional Systems Specialist (ISS) and Dr. Deborah Carlson, Principal, Okinawa District.

Source: Curriculum Integration uploaded on YouTube

What does Curriculum Integration look like?

<table>
<thead>
<tr>
<th>Type</th>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intradisciplinary</td>
<td>Intradisciplinary (least degree of integration): Teachers integrate the sub-areas within a discipline.</td>
</tr>
<tr>
<td></td>
<td>Looks Like</td>
</tr>
<tr>
<td></td>
<td>Integrating reading, writing, and oral communication in language arts.</td>
</tr>
<tr>
<td></td>
<td>Example</td>
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<tr>
<td></td>
<td><em>Making Sense of the World through Disciplinary Integration: (A case study on the use of intra-disciplinary approach towards the study of humanities)</em></td>
</tr>
<tr>
<td>Fusion</td>
<td>Fusion (medium degree of integration): Teachers fuse skills, knowledge, or attitudes in the regular school classroom.</td>
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<td></td>
<td>Looks Like</td>
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<tr>
<td></td>
<td>Incorporating a theme, such as “peace,” through every thread of the school’s curriculum.</td>
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<tr>
<td></td>
<td>Example</td>
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<tr>
<td></td>
<td><em>Fusing curricula: Science and Key Learning Areas (KLAs)</em></td>
</tr>
<tr>
<td>Type</td>
<td>Feature</td>
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<tr>
<td>Service Learning</td>
<td>Service Learning (moderate degree of integration): Involves community projects that occur during class time. Service learning is a teaching strategy that connects classroom curriculum with service projects. Service learning engages students in projects that serve the community while building social, civic, and academic skills. Click the link to see the K-12 Service-Learning Standards for Quality Practice from the National Youth Leadership Council (NYLC).</td>
</tr>
<tr>
<td>Looks Like</td>
<td>Service learning projects should complement academic instruction and make lessons engaging and accessible for even the most disengaged students. In successful projects, teachers guide students in brainstorming and developing new projects or assist them in adapting service learning lesson plans to meet needs in the local community.</td>
</tr>
<tr>
<td>Example</td>
<td>Click the link to access the interactive website, LIFT: Raising the Bar for Service Learning Practice from the National Youth Leadership Council (NYLC) to see exemplar videos, interviews with experts, access articles, planning tools, and lesson plans for service learning projects.</td>
</tr>
<tr>
<td>Learning Centers/Parallel Disciplines</td>
<td>Learning Centers/Parallel Disciplines (moderate degree of integration): Address a topic or theme through the lenses of multiple subject areas.</td>
</tr>
<tr>
<td>Looks Like</td>
<td>Elementary learning centers; Secondary: Study a topic or theme in different classrooms. Teachers sequence their content to meet the content of other classrooms.</td>
</tr>
<tr>
<td>Example</td>
<td>Designing Effective Literacy Centers for the Second Grade Classroom</td>
</tr>
<tr>
<td>Type</td>
<td>Feature</td>
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<tr>
<td><strong>Theme Based Units</strong></td>
<td>Theme Based Units (the multidisciplinary sub-strategy that requires the highest level of integration): Teachers plan collaboratively for a multidisciplinary unit. Three or more subject areas are involved in the study, and the unit ends with an integrated culminating activity. Theme based units are a vehicle for teaching a range of skills and content by integrating curriculum areas around a topic (real-world problem). This method of teaching links curriculum strands and capitalizes on children’s interests, creating a sense of purpose and community in the classroom. By building on their interests and life experiences, young people’s attitudes, skills and knowledge are developed in meaningful ways. Inquiry and communication are activated by a desire to know more, resulting in enthusiastic participation in the learning process (The Intermediate Program Policy Grades 4 to 10, December 1993, Province of British Columbia).</td>
</tr>
<tr>
<td><strong>Looks Like</strong></td>
<td>Students work collaboratively. They are engaged both as presenters and as the audience for performance task presentations. They use a wide range of presentation products, such as video, debate, sculpture, and so on. Students demonstrate depth of understanding of topics as a result of their sustained interest around various questions (e.g., Are the Olympics relevant today? Does the Olympic creed stand the test of time?).</td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td>Exploring a Local Ecosystem from Multiple Perspectives – In this example, students explore the Panda’s Pond from the different disciplinary lenses of science (earth sciences, biology, chemistry, and physics), English (genre readings, analyses, and communication skills), and math (data analysis tools and techniques). The teacher connects the activities to the standards in each discipline. The teacher develops culminating activities that engage students and promotes the development of 21st Century Skills. Click the link to read, <a href="#">Integrated Units: A Planning Guide for Teachers</a> from the Gary and Jeri-Ann Jacobs High Tech High Handbook.</td>
</tr>
</tbody>
</table>
Curriculum Integration Strategies

Multidisciplinary Integration
Multidisciplinary Integration approaches focus mainly on the disciplines. Teachers organize standards from the disciplines around a problem or real-world issue. This approach offers educators a simpler, more efficient way to base instruction on standards in meaningful ways. The world isn’t broken down into disciplines; the multidisciplinary approach to curriculum integration allows students to make cross-curricular connections, which makes learning more relevant. Multidisciplinary integration is several disciplines focused on one problem typically through a common focus or question. Each subject brings a perspective to the problem separately.

Connections

- Relevance is essential to meaningful learning experiences. Engaging students in self-directed, authentic learning is the essence of curriculum integration.
- The tenets of authentic learning, such as project-based learning, interest-based learning, and real-world experiences mirror the tenets of differentiated instruction. Specifically, the interest-based learning, responsive environments, and flexible grouping are the connectors between differentiated learning and curriculum integration.
- Processes and procedures ensure learning is effective and varied for individual learners.
Interdisciplinary Integration

Interdisciplinary Integration is the organization of curriculum around common learning across the disciplines. Interdisciplinary integration is the practice of connecting several disciplines to one problem, issue, or theme from life. Interdisciplinary integration involves relating whole to part, part to whole, and part to part (Meeth, L. R. December 3, 2012).

Interdisciplinary Integration sometimes referred to as "Integrated Studies" combines curriculum from two or more disciplines, allowing students to see how ideas are connected. Teaching in such a contextual manner promotes collaboration, critical thinking, and knowledge retention.

Watch the video to learn about the benefits of an integrated studies approach for student success. Research shows that combining academic subjects produces deeper learning and a better understanding of the interrelationships between them. Click the link to Read a short introductory article or watch an in-depth video provided by Edutopia.
Connections

- Sharing ideas about your discipline and teaching with enthusiastic colleagues with a common goal.
- Common learning goals are addressed by multiple teachers in different classes - more efficient way to teach, increased student success.
- Seeing one’s own discipline from a fresh and energizing perspective - builds excitement about teaching.
- Opportunity to learn from students’ sometimes unexpected interdisciplinary connections.
- Students see teachers’ model continued learning, interest in their discipline and in those of others, collaborating with peers, making connections between what they know and new ideas, working from new and different perspectives, problem-solving, creativity, flexibility.
- Real-world learning, not isolated educational experiences
- More opportunities for students to connect new learning with what they know and are interested in.
- Provides more ways for students to learn and demonstrate their skills and understandings.
- Highlights students’ strengths; builds confidence to overcome challenges learning new/difficult concepts.
- Encourages students to become personally invested in their work (since they are given the privilege and responsibility of making choices about what and how they learn and demonstrate their learning).
Transdisciplinary Integration

Transdisciplinary Integration is the process by which teachers organize curriculum around student questions or concerns. Students develop life skills as they apply disciplinary and interdisciplinary skills into real-life contexts (Drake and Burns, 2004). Transdisciplinary integration starts with the problem and through problem solving uses the disciplines that contribute to the solution (Meeth, L. R. December 3, 2012).

Connections

- Teachers organize curriculum around student-centered questions and concerns which results in differentiation for students.
- Students develop life skills as they apply interdisciplinary and disciplinary skills into a real-life context.
- Relevance is essential to meaningful learning experiences.
- Providing a construct for students to engage in study that focuses on their interests, knowledge base, and/or passion increases those critical connections between learning and real life applications/problem solving.
- Students use networking to obtain data, widening their knowledge base through real world application.
- Wagner’s student outcomes result from the transdisciplinary strategy to curriculum integration.
- Students go far beyond the minimum effort, when they take ownership.
- Students make connections among different subject areas to answer open-ended questions.
- Students retain what they have learned and apply learning to real-life problems.
# Comparing and Contrasting the Three Approaches to Integration

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Science, Technology, Engineering, and Mathematics (STEM)

Science, Technology, Engineering, and Mathematics (STEM) education is the intentional interdisciplinary approach to learning where the core curriculum is coupled with real-world project-based learning using the Engineering Design Process to develop STEM literacy. STEM literacy is the ability to identify, apply, and integrate concepts from science, technology, engineering and mathematics to understand complex problems and to innovate to solve them.

DoDEA STEM Education

DoDEA STEM Education is an educational program designed to provide students with opportunities to be successful in the fields of Science, Technology, Engineering, and Mathematics. Our purpose is to ignite the passion of students to pursue education and careers in STEM disciplines. The three goals of DoDEA STEM Education are to:

- Create K-12 student interest, participation, and achievement in higher levels of math, science, and technology through the engineering design process,
- Attract and retain students to STEM fields with a focus on underrepresented and female populations, and
- Support the national security focus on the shortage of STEM professionals.
Watch the video below to hear Energy Secretary Steven Chu and business leaders discuss how, with an understanding of Science and Math, individuals are shaping the world we live in.

Source: Changing the Equation in STEM Education uploaded on YouTube by The White House

Click the link, DoDEA STEM website to learn more about STEM Education in DoDEA!

Connections
STEM education may be enhanced through further integration of all subjects, such as language arts, social studies, art, etc. "(Sanders & Wells, 2010)

Learners will:

- Develop a shared understanding of STEM education.
- Develop a working knowledge of research-based effective learning experiences in science inquiry, mathematics problem-solving and engineering.
- Immerse themselves in the processes of science through an engaging scenario modeling instructional practices to deepen their understanding of teaching and learning in the STEM fields.
Frequently Asked Questions (FAQs) about STEM

1. **Why is STEM education important to DoDEA?**
   Competence in STEM, especially proficiency in mathematics and science gained in grades K-12, forms the foundation of an educated, capable, and technical future workforce. Likewise, careers in STEM fields contribute greatly to the nation’s capacity for innovation, our national defense and are among the fastest-growing and highest-paying careers in the economy. Therefore, it is vital that we engage and prepare students in STEM education as well as excite them about career opportunities in STEM.

2. **What is DoDEA’s Role in STEM?**
   STEM education is driven by a national demand to prepare students to live and work in a world of computers, advanced telecommunications, bioengineering, robotic surgery, human-machine interaction, and much, much more; and what supports this effort is the work that happens in our schools.

During School Year 2012, DoDEA undertook the following to promote STEM education 1) piloted four engineering applications courses- Biotechnology Engineering, Gaming Technology Engineering, Green Technology Engineering, and Robotics and 2) launched a system wide awareness campaign to communicate the importance of STEM education, which included a week-long STEMposium. However, these efforts are only one prong of DoDEA’s multifaceted approach to advance STEM education.

As we move forward, it is important to recognize that DoDEA’s main STEM goal is to increase the number of students, particularly those from traditionally underrepresented groups, who are prepared for post-secondary studies and careers in STEM.

To accomplish this goal, proficiency in mathematics and science is foundational knowledge that all students need to acquire, and a solid knowledge base in these areas enables students to succeed in high school, college and careers. More
importantly, mathematics should be a gateway, not a gatekeeper, to a successful college education or career.

For that reason, this school year DoDEA ramped up its efforts to increase student proficiency in mathematics by increasing graduation requirements in mathematics and by adding four new courses (Algebraic modeling, Advanced Functions, Financial Literacy, and Engineering Applications). We want students to see mathematics as an essential aspect of their everyday lives, no matter what their field of study, and to believe, “I can understand this, I can do this, and this is important to know now, for my future, and for life.”

By the same token, we will expand efforts to support an effective STEM-focused approach to existing curricular resources in the K-12 environment through implementing the Common Core State Standards in Mathematics and Next Generation Science Standards. We recognize that the implementation of the new standards will require a transdisciplinary approach for teaching and learning.

3 How do partnerships contribute to advancing STEM in DoDEA?

Partnerships with STEM professionals connect K-12 students and teachers with real world experiences in science, technology, engineering and mathematics. Research shows that providing opportunities for students to see themselves excelling in STEM activities and exposing them to professionals with similar cultural backgrounds increases the potential in students, especially for girls and under-represented minorities, to develop foundational skills in STEM.

The Department of Defense is poised to make a tremendous difference in STEM education. The Department employs tens of thousands of scientists, engineers and mathematicians at state-of-the-art research facilities and is the leader in technological
advances. Recognizing this potential, DoDEA and the Department of Defense are in the process of aligning our efforts.

As we look outward to the future, we recognize that a growing body of research shows that a key limiting factor for students not focusing on STEM studies and careers lies with comprehension and understanding key concepts. Failure to grasp fundamental concepts early has negative cascading effects in later STEM subjects.

With that being said, DOD’s modeling and simulation technology can provide the means to expand learning beyond text-based facts or solving equations. Models and simulations can help students understand hard to grasp concepts in science and mathematics.

DoDEA and Naval Air Warfare Center Training Systems Division (NAWCTSD), on behalf of Team Orlando, has established a partnership for the purpose of leveraging the strengths of both organizations in the mutual pursuits of advancing Science, Technology, Engineering, and Mathematics (STEM) education.

NAWCTSD and DoDEA will work together to develop modeling and simulation strategies to support learning STEM content. With this objective in mind, we will develop simulations that provide a number of visualization vignettes to augment teaching and learning. This will provide multiple benefits, that is, the simulations will:

1. Involve students in hands-on experiences so they become participants, not mere listeners or observers;
2. Mimic the activity so well that there is little difference between the simulated environment and the real one;
3. Motivate students to learn through deep involvement in the activity so that interest in learning is more about the activity and the subject matter develops by doing, and;
4. Encourage students to enhance the activity by contributing their own ideas.
What is Engineering by Design?

The Engineering Design Process is a series of steps that engineers use to guide them as they solve problems. Many variations of the engineering design process model exist. The Engineering Design Process is cyclical and can begin at any step, or move back and forth between steps numerous times.

Moving through the Engineering Design Process might involve asking the following questions or making the following decisions:

**ASK**

- What is the problem?
- What have others done?
- What are the constraints?

**IMAGINE**

- What are some solutions?
- Brainstorm ideas.
- Choose the best one.

**PLAN**

- Draw a diagram.
- Make lists of materials you will need.
CREATE

• Follow your plan and create it.
• Test it out!

IMPROVE

• Talk about what works, what doesn't, and what could work better.
• Modify your design to make it better.
• Test it out!

Source: Engineering is Elementary. Museum of Science, Boston. Available at http://www.eie.org/content/engineering-design-process

What are Simulations?

Simulations (and models, too) are abstractions of reality. Often they deliberately emphasize one part of reality at the expense of other parts. Sometimes this is necessary due to computer power limitations. Sometimes it's done to focus your attention on an important aspect of the simulation. Simulations generally come in three styles: live, virtual and constructive. A simulation also may be a combination of two or more styles. Within these styles, simulations can be science-based (where, for example, interactions of things are observed or measured), or involve interactions with humans.

Three main types of simulations include:

1. Live Simulations: Typically involve humans and/or equipment and activity in a setting where they would operate for real. Think war games with soldiers out in the field or manning command posts. Time is continuous, as in the real world. Another example of live simulation is testing a car battery using an electrical tester.
2. Virtual Simulations: Typically involve humans and/or equipment in a computer-controlled setting. Time is in discrete steps, allowing users to concentrate on the important stuff, so to speak. A flight simulator falls into this category.
3. Constructive Simulations: Typically do not involve humans or equipment as participants. Rather than by time, they are driven more by the proper sequencing of events. The anticipated path of a hurricane might be "constructed" through application of temperatures, pressures, wind currents and other weather factors. Science-based simulations are typically constructive in nature.

What is modeling?

A computer model, as used in modeling and simulating science, is a mathematical representation of something—a person, a building, a vehicle, a tree—any object or variable. A model also can be a representation of a process—a weather
pattern, traffic flow, air flowing over a wing. Models are created from a mass of data, equations and computations that mimic the actions of things or variables represented. Models usually include a graphical display that translates all this number crunching into an animation that you can see on a computer screen or by means of some other visual device. Models can be simple images of things—the outer shell, so to speak—or they can be complex, carrying all the characteristics of the object or process (variables) they represent. A complex model will simulate the actions and reactions of the real thing. To make these models behave the way they would in real life, accurate and real-time simulations require fast computers with lots of number crunching power.

Additional Resources for Educators

**National Defense Education Program LabTV** - includes video episodes that demonstrate the amazing research that is everyday work at DoD labs. We are in the process of aligning the videos to science lessons for classroom use. *DVR/CD sets of these videos are available upon request.

**eCYBERMISSION** - sponsored by the U.S. Army and managed by the Research, Development and Engineering Command, the competition is designed to share the importance of Science, Technology, Engineering and Mathematics (STEM) education with the leaders of tomorrow and encourage them to understand the real-life applications of these subjects. The competition is open to all states, territories, and DoDEA, which is considered as a state for this competition.

**The Junior Science Humanities Symposium (J SHS)** - sponsored by the Armed Forces the program is designed to encourage and recognize the next generation of scientific talent. Sponsors include the Office of the Assistant Secretary of the Army (Acquisition, Logistics & Technology), the Office of Naval Research, and the Air Force Office of Scientific Research, in cooperation with higher education.

**MATHCOUNTS Real Math Challenge** - sponsored by the Department of Defense is an innovative program involving students using cutting-edge technology to create videos about math problems and their associated concepts. The Real Math Challenge allows students to hone creativity and communication skills in a math setting. These skills are not typically the focus of most traditional math classroom activities, yet they are essential for success in future STEM careers.

**West Point Bridge Design Contest** - the purpose of the contest is to provide middle school and high school students with a realistic, engaging introduction to engineering.

**Research and Engineering Program (REAP)** - encourages high school students, 16+ years of age, to pursue careers in math, science and technology through hands-on experience in research and development. REAP apprentices are high-school age students selected for their interest in science, technology, engineering and mathematics (STEM). Special consideration is given to under-represented groups. REAP
apprentices typically spend a summer in a university research program under the guidance of a professional mentor.

**EngineerGirl** - is a service of the National Academy of Engineering (NAE). The website is part of an NAE project to bring national attention to the opportunity that engineering represents to all people at any age, but particularly to women and girls.

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**Engineering, Go For It (eGFI)** is sponsored by the American Society for Engineering Education (ASEE) to promote and enhance efforts to improve K-12 STEM and engineering education.

**National Action Council For Minorities In Engineering (NACME)** - the nation’s largest private provider of scholarships for underrepresented minority students in engineering, supports collaborations with other non-profit organizations to provide pre-engineering study preparation and experiences for public school and community college students and has become a leading source of research results and policy analysis regarding the participation of African Americans, Latinos and American Indians in engineering education and careers.

**Department of Defense (DoD) STARBASE** - DoD STARBASE focuses on elementary students, primarily fifth graders. The goal is to motivate them to explore Science, Technology, Engineering and Math (STEM) as they continue their education. The academies serve students that are historically under-represented in STEM. The program engages students through the inquiry-based curriculum with its “hands-on, mind-on” experiential activities.

Research


**Federal News Radio.** *DoD should recruit from global STEM workforce, report says.*

**The Education Trust.** *Shut Out of the Military: Today’s High School Education Doesn’t Mean You’re Ready for Today’s Army.*

**Department of Defense (DoD).** *DoD Science, Technology, Engineering, and Mathematics (STEM) Executive Board STEM Strategic Plan FY 2013-FY 2017.*
Technology Integration Strand

Technology integration empowers learners to share self-generated knowledge and make real-world connections that reach beyond school walls. Technology provides educators opportunities to utilize innovative and engaging teaching practices, expanded learning communities, and current information. Appropriate integration of technology increases student achievement, supports responsive and inclusive instruction and provides collaborative learning experiences that promote college and career readiness in a global society.

Big Ideas

- Technology enables student collaboration and tends to result in improved achievement. Educators and technology provide realistic, complex environments by furnishing investigative tools and data resources, and linking classrooms for joint investigations (Means & Olson, 1997).
- Sophisticated interactive software creates opportunities for students to learn by doing, receive feedback, continually refine understanding, and build and represent new knowledge (Barron et al., 1998).
- Integration of technology with curriculum increases student achievement. Significant student achievement gains for technology integrated with standards were demonstrated by an eight-year longitudinal study of SAT-I performance at New Hampshire’s Brewster Academy (Bain & Ross, 2000).
• Educational researchers and practitioners agree that the potential of new technologies for learning is found not in the technologies themselves, but in the way these technologies are used as tools for learning (Owsten, 1997; Valdez & McNabb, 1999).

• Much of the software available can be used to improve thinking skills. Visualization tools enable users to discern patterns and detect relationships (Brodie et al., 1992; Kaufmann & Smarr, 1993).

• Technology does affect academic achievement, but is dependent on how the technology is used. Grade-appropriate use of computers is more important in producing increased learning than the amount of time computers are used. Asking students to apply higher order concepts is associated with significant learning gains (Wenglinsky, 1998).

• Using peripheral devices allows you to create new opportunities for developing effective curriculum and instruction (Bransford, Brown, & Cocking, 1999).

• Technology provides a widespread audience for students' work. Computers link students to the world, provide new reasons to write, and offer new sources of feedback on ideas (Peck & Domicott, 1994).

• When students use the Internet to research topics, share information, and complete a final project within the context of a semi-structured lesson, they become independent, critical thinkers (Coley, Cradler, & Engel, 1997).

• Students gain a greater sense of responsibility for their work through the use of technology. They produce higher-quality assignments that reflect the increased depth and breadth of their knowledge (Glennan & Melmed, 1996).

• Students today are accustomed to working within networked environments. To a student in the 21st Century a networked environment may include their home computer, cell phone, handheld, and personally designed Web sites (Tapscott, 1998).
Networked technology enables teachers and students to build local and global communities that connect them with interested people and expand opportunities for teacher learning (Kozma, 2003).

Looks Like/ Sounds Like

Students will:

- Demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.
- Use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
- Apply digital tools to gather, evaluate, and use information.
- Use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.
- Understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.
- Demonstrate a sound understanding of technology concepts, systems, and operations.

ISTE’s NETS for Students (NETS•S) are the standards for evaluating the skills and knowledge students need to learn effectively and live productively in an increasingly global and digital world.
Integrating technology with classroom practice can be a great way to strengthen engagement by linking students to a global audience, turning them into creators of digital media, and helping them practice collaboration skills that will prepare them for the future. Click the link to read a short introductory article.

Source: An Introduction to Technology Integration uploaded on YouTube by Edutopia

Technology Integration Strategies

Curriculum

With the appropriate integration of technology with curriculum, students will have access to broad a range and depth of content and resources that are relevant and engaging. A digital environment provides and organizational structure for efficient access to current information from multiple locations. This flexibility will help to meet the needs of each learner and the content being studied, foster ownership in the process of learning, and increase critical thinking skills as well as the 21st Century Learner Outcomes.
Watch the video below to see how innovative teacher Vicki Davis leverages wikis, blogs, digital storytelling, podcasts, virtual worlds, and other digital tools to connect students to the global world.

Source: Harness Your Students' Digital Smarts uploaded on YouTube by Edutopia

Connections
Purposefully select curriculum technology tools that engage and empower the student in the content to be learned. Such curriculum technology tools might be:

- Digital textbooks for reading, analyzing content
- Internet resources for research
- Teacher designed websites for information, assignments, posting, responding, sharing content
- Blogs and wikis to share and respond to ideas around the world
- Tablets, laptops, cell phones for engaging in content

Instruction
The tools of technology enable teachers to design and facilitate instruction that is engaging, responsive, inclusive, and collaborative. As a result, students are involved in real world connections beyond the walls of the classroom, apply 21st Century Learner Outcomes to their work, and have access to instruction tailored to their individual learning style. In the video, you will see a seventh grade student’s perspective of her own personal learning environment. It demonstrates real world learning that is personal, authentic, and engaging using 21st Century Teaching and Learning practices.
In the video, you will see how Robert Pronovost, a second-grade teacher, tailors math instruction to match students’ individual learning styles.
Connections

Purposefully select instructional technology tools that facilitate the content and the instruction by engaging students in intentional learning outcomes. Examples of instructional technology tools are:

- Innovative use of Smartboard
- Teacher developed websites
- Online instructional platforms (Google apps, Adobe Connect, and Schoology Learning Management System)
- Video/audio podcasts (production and distribution)
- Microsoft Office Products (Word, PowerPoint, Excel, Outlook; many features are underutilized)
- Subject Specific Tools for specific content:
  - Vernier (Logger Pro)
  - Texas Instruments (graphing calculators, etc.)
  - Turnitin.com

Assessment

The tools of technology assess progress by collecting, analyzing and organizing student information. The immediate feedback can be used by students to promote ownership of learning and provide multiple opportunities for growth. Teachers can use the information compiled and analyzed by technology to inform instructional decisions (differentiated instruction, flexible grouping, readiness, enrichment, etc.) that result in increased student achievement. Technology platforms can be used by students to create products for formative as well as summative assessments and document growth (digital portfolios).

Assessment Tool Examples

- Handheld Response Systems
- Online platforms (publisher provided/teacher generated)
- Digital Portfolios (ePortfolios)
  - Students record summaries of work samples/audio recordings of problem solving
- Various software to create student products
- Social media that provide a mix of creative expression and group work through tasks like contributing to a blog, designing websites, uploading video presentations, and creating Facebook pages for class projects
- Digital platforms for organizing and submitting/receiving feedback
Watch the video below to see how educators at Forest Lake Elementary School use frequent formative assessments to determine the needs of each student, and then use technology to address their individual learning styles.

Source: How Differentiated Instruction and Formative Assessment Work at Forest Lake Elementary uploaded on YouTube by Edutopia

Connections

- Using frequent feedback from students to tailor instruction to address students' interests and learning needs improves student achievement (Black and Wiliam, 1998; Light and Polin, 2010; Thissen-Roe et al., 2004).
- Online tools for embedded and ongoing assessments help instructors to more quickly and frequently understand what students know in order to tailor instruction to better address their learning needs.
- Embedding on-going assessment into curriculum has been shown to improve student learning, particularly for struggling students and when assessments reveal students' thinking processes in ways that inform instruction (Black and Wiliam, 1998).
Handheld Response Systems

Technology helps teachers to gather, analyze, and act upon student feedback more efficiently through the use of audience response system (ARS) also referred to as a Handheld Response System. It is important to remember that audience response systems themselves are not as important as the effective teaching and learning strategies that they facilitate, which include the following (Lemke, Coughlin, and Riefsneider, 2009):

- Checking for real-time student understanding of content being taught
- Diagnosing student misconceptions and misunderstandings
- Displaying responses of the group to trigger discussion and reflection
- Gathering formative data to guide instruction
- Saving time in administering and scoring quizzes
- Introducing and monitoring peer learning methods

Additional Resources

Click the link to access Edutopia’s, Technology Integration Research: Additional Tools and Programs.

Click the link, Using E-Portfolios in the Classroom to learn more about the ePortfolio and to access free online applications for students to use when creating an ePortfolio from Edutopia.

Click the link, http://electronicportfolios.com/ to access Dr. Helen Barrett’s ePortfolio website. This website contains extensive research on the benefits of using ePortfolios with students and free web 2.0 tools to use to design an ePortfolio. This website also includes extensive research on the ePortfolio in the K-12 educational setting.

Watch the video from TED Talks to see Dr. Helen Barrett discuss the advantages of the ePortfolio on student engagement and development in life-long learning. Dr. Barrett describes the similarities and differences between social networks and the ePortfolio. According to Dr. Barrett, the boundaries between these two processes are gradually blurring. As we consider the potential of lifelong ePortfolios, will they resemble the structured accountability systems that are currently being implemented in many higher education institutions? Or are we beginning to see lifelong interactive portfolios emerging as mash-ups in the cloud?
Communication

Technology integration into communication includes all processes for online communication/production/access both synchronous and asynchronous among all stakeholders. Co-director of the National Writing Project Elyse Eidman-Aadahl describes how the craft of storytelling is evolving, as new digital tools and communications technologies enable connections for content creators around the globe.

Connections

Purposefully select communication technology tools that support the intended outcomes. Examples of communication technology tools include:

- Surveys
- Google Apps: for asynchronous/blended instruction and collaborative communication
- Gradespeed/ASPEN: for a communication platform to include posting of resources and customized message on grade reports
- Email: for student email (Gaggle) parent distribution
- Websites: for school website, Google Apps, YouTube
- Social Media: for Google Apps, Facebook
- Video Teleconference: for DoDEA Telepresence Systems
- Web Conferencing: for Defense Connect Online (DCO)
Military Connected Child Strand

The Military Children are those whose parents serve the nation. In turn, the military connected children face many challenges and special circumstances that are different from those experienced by civilian children and their families. These challenges and circumstances include gaps in school attendance and learning due to frequent moves, families being separated due to parental deployment, and a sense of isolation when they transfer to schools in the midst of a civilian community.

Big Ideas
It is important that military children, no matter where they live or what military branch their family serves receive a quality education and academic continuity from PK-12th grades. Supporting military connected children takes a broad, unified approach where the teachers, leadership, parents, and community work collaboratively to positively impact the child’s growth and development. Therefore educators must be familiar with and responsive to the strengths, needs, and individuality the military child and their families in order to:

- Raise awareness about the unique challenges facing our military children.
- Ensure inclusive, quality educational experiences for all military connected children affected by mobility, family separation, and transition.
- Provide responsive and relevant support systems, resources, and products that lead to academic continuity.
Characteristics of the Military Child

- Have an authentic connection to other countries that offers cultural and academic opportunities rarely experienced in other school settings.
- Have a sense for local culture but may lack specific knowledge about the places where their parents are deployed that might be assumed they know about (i.e. Afghanistan or Iraq).
- Attend smaller schools mostly where students have multiple opportunities to participate in extracurricular activities as opposed to typical schools in the United States that have greater competition due to large enrollments. This is particularly true of middle and high schools. Involvement in many activities creates challenges for students to find a balance between academics and other interests.
- Are culturally sophisticated but may not relate to the pop culture that permeates the lives of the students who live the majority of their lives in the United States.
- May experience social, emotional and academic stress due to the frequent deployments and family moves.

Services provided by DoDEA Schools for Military Connected Students

<table>
<thead>
<tr>
<th>Service Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Military Family Life Consultant</td>
<td>Contracted mental health counselors who work directly with children and families on an informal, on-going basis within DoDEA schools.</td>
</tr>
<tr>
<td>School-Based Mental Health Professionals</td>
<td>Employees of installation hospitals who work with children and families who are patients receiving mental health counseling.</td>
</tr>
<tr>
<td>School-based Guidance Counselors</td>
<td>DoDEA certified counselors who create school programming, operate small groups, and give individual counseling on an as-needs basis. Usually serve as a coordinator of all available services within a school to help ensure that students’ needs are met.</td>
</tr>
<tr>
<td>School Psychologists</td>
<td>DoDEA certified employees who assess students for special needs, and provide counseling and instruction for children.</td>
</tr>
<tr>
<td>Crisis Teams</td>
<td>School personnel who have received special training to deal with students in severe crisis.</td>
</tr>
<tr>
<td>Student Support Teams</td>
<td>School personnel who serve as advocates for children and their special needs within the school setting.</td>
</tr>
<tr>
<td>School Nurse</td>
<td>Certified Nurses at DoDEA schools provide individualized quality health care for students, emphasizes health education at all levels and utilizes available community and school resources to promote an overall healthy lifestyle for students, staff and families.</td>
</tr>
</tbody>
</table>
The Military Connected Child Strategies

The Child

American service men and women are parents of about 2,000,000 children. These children are primarily young; of those children who are in school, 57% are between the ages of six and eleven. These children move to a new duty station every three to four years, on average, with some moving with much more frequency. Some students may have four to six different schools in the course of their education. Even when their family stays put, however, the children face multiple challenges; not only do they often have a military parent deployed, sometimes for over a year at a time, but they also have classmates and neighborhood friends who rotate to new duty stations every few years.

Connections

- Despite the stressors and hardships brought by the deployment and permanent change in station moves, military kids are optimistic, eager and remarkably well-adjusted students.
- Most military children earn good grades, are statistically similar to their civilian peers in their long-term physical and mental health, and report a general satisfaction with life in similar numbers as their civilian peers.
- Our role in the DoDEA schools is to understand the unique challenges facing military connected students and provide, not only the academic environment our students need for success, but also a nurturing atmosphere and support services they need to thrive.

The Family

The military family is an all-inclusive term representing the parents and guardians of school-age children of military members. These families include active duty service men and women that move every two to three years. The average military child therefore experiences six to nine moves during their PK-12 school career. This is approximately three times more often than the civilian population. Due to high rates of student mobility, the effects of multiple deployments, and a variety of military transformations, military families can often encounter many school challenges involving enrollment, eligibility, placement, transfer and graduation. Thus for military families, is not
only important for their children to do well in their current schools; they must also be prepared to do well in their next location.

Connections

- Military connected children may experience difficulties adjusting to curriculum and instructional methods or school climate/culture that may differ from school to school.
- Schools can provide stability and predictability to children during a period of great change.
- Schools should work with military families to ensure continuity in education from the enrollment day through graduation.

The Community

The greater military community recognizes its role as a support to the families of those who serve and provides many resources to that end. Local installations offer a variety of resources to which our military families and their students are able to access. They may include installation and/or hospitals based mental health resources, Military Family Life Consultants, crisis hotlines, Federal mental health services, social work services, Family Advocacy Programs and Marriage/Family Therapy Programs. The availability of these services varies depending on the size and location of the installation.

Connections

DoDEA schools play a critical role in the local installation’s community life:

- Serve as communicators of services available within the community
- Highlighting community resources in newsletters
- Inviting community resource personnel to large scale school events
- Serve as direct access points for some community services
- Military Family Life Consultants providing services during the school day
- School Based Mental Health Provider providing services during the school day
- Serve as microcosmic communities for their students and families
- Building connection at the school and classroom level using curricula for team-building
- Providing students with formal and informal opportunities to process their emotions and reactions to stressful events
The Leadership Strand focuses on school leadership, transformational leadership through shared leadership model. Leaders who build their school culture around shared leadership develop strong ownership of the work, collaboration, strong relationships, and ownership of the results of the work. The Leadership Strand supports the various roles of the 21st Century roles of leaders in the school - administrators, teachers, and students.

Big Ideas

Shared Leadership: 21st Century leaders transform the educational community through a shared vision that promotes continuous school improvement, effective professional practice, digital age learning and citizenship through shared leadership. The strategies under the shared leadership strand include:

- Administrative leadership
- Teacher Leadership
- Student Leadership

Research indicates that the one factor distinguishing successful 21st century schools and districts is strong leadership. While individual teachers can adopt the practices of a 21st century classroom, the real impact on students is if an entire school and district embraces and works toward the same vision.
In the video below, you will hear Ken Kay, Chief Executive Officer of EdLeader 21 and superintendents of top performing school districts throughout the United States discuss the importance of transforming schools through strong 21st century leadership.

Source: The Role of Leaders in 21st Century Education uploaded on YouTube by EdLeader21

Shared leadership includes the following three strategies; each being equally important and all three working together with the same vision to accomplish the goals of the school.
Administrative Leadership

21st Century administrators transform the educational community through a powerful and dynamic presence that promotes continuous school improvement, effective professional practice, and digital age learning and citizenship. The 21st Century Principal leads and promotes a shared leadership model. The 21st Century Principal leads through visionary leadership, instructional leadership, organizational leadership, and collaborative leadership.

Three Roles of the School Administrator

<table>
<thead>
<tr>
<th>Role Description in School</th>
<th>Role as a Coach/Facilitator</th>
<th>Role as Change Agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Provide a safe, collaborative and risk-free environment for all stakeholders</td>
<td>• Endorse excellence in professional practice</td>
<td>• Endorse excellence in professional practice</td>
</tr>
<tr>
<td>• Ensure a rigorous, relevant, and engaging education for all students</td>
<td>• Model the facilitation of instruction and the support of programs</td>
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</tr>
<tr>
<td>• Promote and participate in local, national, and global learning communities that stimulate innovation, creativity, and digital age collaboration</td>
<td>• Promote a trusting environment of professional learning and innovation that empowers educators to enhance student learning</td>
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</tr>
<tr>
<td>• Promote and model effective communication and collaboration among stakeholders using digital age tools</td>
<td>• Collaborate to establish metrics, collect and analyze data, interpret results, and share findings to improve staff performance and student learning</td>
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</tr>
<tr>
<td>• Model and facilitate the development of a shared cultural understanding and involvement in global issues through the use of contemporary communication and collaboration tools</td>
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</tbody>
</table>

Visionary Leadership + Instructional Leadership + Organizational Leadership + Collaborative Leadership = 21st Century Principal
**Teacher Leadership**

Teacher leaders are embedded into the school site through teaching in classrooms, serving as instructional coaches, and fostering change through the CSI process. The role of the teacher leader is to enhance student achievement through promoting effective teaching practices in all classrooms and contributing to collective leadership in the building. Teacher leadership is built on the [Teacher Leader Model Standards](#).

**Three Roles of a Teacher Leader**

<table>
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<tr>
<th>Role Description in School</th>
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<th>Role as Change Agent</th>
</tr>
</thead>
</table>
| • Working collaboratively with large and small group specialists  
  • Co-teaching and Co-planning lessons  
    o Horizontal articulation  
    o Vertical articulation  
    o Cross-curricular integration  
  • Leading Professional development in areas of strength  
  • Distributed/Shared leadership - Participating in school decisions  
  • Leading small group committees or teams  | • A quality site-based instructional coach at each building will provide the structure needed for teachers to work collaboratively to enhance student achievement through co-teaching and ongoing job-embedded professional development.  
  • Serving as an instructional coach  
    o Co-teaching  
    o Model teaching  
    o Providing “just in time” staff development  
    o Preparing resources, materials  
    o Helping colleague grow as professionals and reach PGP goals  
  • Leading teachers in strategic staff development, including:  
    o Facilitating 21st CTLL trainings  
    o PLTs, studies of need or interest  
    o Grade level collaboration  
    o Workshops  
    o Staff development days  | • Teacher leaders foster change through actively promoting the mission and vision of the school to promote highest student achievement  
  • Contributing to the mission and vision of the school  
    o Act as an agent of change through informing, leading, and modeling for stakeholders  
  • Developing capacity of others  
  • Designing and/or implementing professional development  
  • Foster a shared belief to build a positive school community  
  • Work collaboratively with colleagues and administrators to design and implement curriculum, instruction, and assessment  
  • Model the use of data to drive instructional practices and teach others to implement this practice |
**Student Leadership**

Students act as leaders in the classroom by demonstrating competency in using and applying tools to process, organize, and analyze information. They work collaboratively with peers and teachers to support and empower others to use the tools successfully.

### Three Roles of a Student Leader

<table>
<thead>
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</thead>
<tbody>
<tr>
<td>• Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology</td>
<td>• Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others</td>
<td>• Students help teachers and peers to use technology in classrooms, supporting effective technology integration school-wide.</td>
</tr>
<tr>
<td>• Students apply digital tools to gather, evaluate, and use information</td>
<td>• Students understand human, cultural, and societal issues related to technology and social interactions and practice legal and ethical behavior</td>
<td>• Students support peers through academic tutoring, mentoring, and participation in school activities and clubs.</td>
</tr>
</tbody>
</table>
References


Bergman, J. and Sams, A. 2012. Reach Every Student in Every Day Every Day.)


Teacher Leader Model Standards available at http://www.teacherleaderstandards.org/


