RIT | National Technical Institute for the Deaf

DEAFTEC STEM CURRICULUM

GUIDELINES

Crucial points are summarized here as you consider using this STEM curriculum in your classroom:

COMMUNICATION:

Communication is fundamental to the academic success of all students and is often taken for granted. In environments where Deaf, Hard of Hearing and hearing students study and attend classes together the assumption that communication "just happens" is especially detrimental. While having an interpreter or captionists in the classroom enhances access, it does not address all aspects of accessibility. A truly accessible classroom environment requires thought, planning, conscious effort and teamwork.

PACE:

You are feeling the pressure to get through as much of the required course material as quickly as possible. In your rush to cover the material you talk rapidly, move quickly through overheads, and hold class questions to a minimum.

You are presenting new concepts and new vocabulary so quickly that the interpreter or captionist is frequently asking you to repeat information so that he/she can catch up.

Although you are not aware of it until later, often the interpreter or captionist finds himself/herself in the situation of conveying just the core of the information presented; the interpreter or captionist does not have time to signal the deaf and hard-of-hearing students when there is a change of topic because the information is being presented at such a rapid pace.

GIVING DIRECTIONS:

Perhaps you've never considered the difficulties for deaf and hard-of-hearing students, even with an interpreter or captionist present, in trying to learn from spoken directions or a demonstration. But directions/demonstrations often involve pointing at different items –for example in a lab setting, or indicating steps to be followed on a computer screen.

Deaf and hard-of-hearing students are expected to look at two places at once: first they look at the interpreter or captioning if available (or you if they are speechreading), and second they look at the object of the directions.

STRATEGIES

Suggestions for strategies you can use if you believe that your pace is too fast to follow.

SLOW DOWN

We know it's tough but you should be aware that the rapid pace of instruction was one of the top areas of concern by deaf, hard-of-hearing, and hearing students in responses to a recent survey.

If you are presenting the material at a fast pace, and you know it, slow down; if you have never thought that the pace was too rapid, reconsider this as a possibility.

RETHINK AND REDUCE

Present additional material in alternate formats such as in homework assignments, as part of a required group project, as a reading assignment, or as an online learning activity.

When you are presenting material in class, provide pacing clues by clearly indicating when you are changing topics. Verbally indicate that the topic is changing, pause, point to a new line in the overhead, draw a line on the board, etc.

PAUSE

Check with the interpreter or captionist if present or with hard-of hearing students who may not have an interpreter or captionist, to make sure that they are able to keep up with the lecture.

Describe each step of a process or technique before performing it, and then pause to allow students to shift their attention. Then take the step yourself, without comment.

Repeat this procedure throughout the process of giving directions or a demonstration.

PLACEMENT

Face these students whenever you speak to ensure a good line of sight. Be certain that the lighting reveals your face; do not stand in front of a window or in a shadow.

Do not talk while you have your back to the class or while looking down at a computer. For example, when writing on the board do not speak; instead, finish writing then turn, allow students time to read the material, and finally face the class and talk.

See more on next page.

STRATEGIES

Suggestions for strategies you can use if you believe that your pace is too fast to follow.

REPEAT QUESTIONS/COMMENTS

Repeat questions or comments from another students; keep in mind this is important since the hard-of-hearing student will be focused on you, not looking around trying to identify and follow the current speaker.

USING OVERHEAD

When you are writing on overheads, remember that you will be looking down and your lips may not be easily visible. Again—finish writing, and then start to speak. Allow time for students to look at the overhead before talking.

The light from an overhead may make it difficult to see your face clearly. When you speak, be certain you are not in the overhead light, or near the projector. Step away from the overhead by a foot or two before continuing your lecture. Instead of moving into the light, use a pointer to refer to the content of the overhead.

VOICING / MOVEMENTS

Consider whether your voice carries well in your lecture room; if not, request a microphone, especially in large lecture halls. Consider the use of loop system – an amplification system that transmits your voice from a microphone you wear to hearing aids equipped to receive this signal.

Minimize arm and hand movements, and do not cover your face or mouth with your hand while speaking. Be vigilant regarding other strategies that can be used to increase student access to the information you present.

WRITING ON BOARD

Write important words and formulas on an overhead or the board. Do not speak until the words or formulas are completely written. Use this method to force you to slow the pace of the lecture. If an overhead is prepared, provide students – and interpreter, captionist, and notetaker if present – with a copy.

Providing handouts, and writing announcements, vocabulary, assignments, and similar material on the board ensures that your message is communicated.

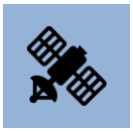
ADDITIONAL MATERIALS: Teaching Tools and Handouts - http://deaftec.org/classact/tools/library

WHAT YOU NEED TO KNOW

What you need to know before teaching these STEM lessons:

NEW VOCABULARY

Just like the English language evolved to accommodate new words for the computer age (e.g., spam, memes, gif, unfriend, hashtag), ASL is developing new signs for STEM words. There is an ASL STEM Dictionary available online: http://www.deaftec.org/stem-asl-video-dictionary



STEM ACTIVITIES ARE FUN!

One of the cornerstones of a transition to a Common Core curriculum has been a focus on the development of higher-level problem solving skills. Access to meaningful and personalized academic instruction.

IT'S OKAY TO TRY NEW IDEAS!

We encourage teachers to try out these lessons before introducing them to their students. This will help you get a sense of how many different ways each lessons can be approach and how the activities can lead to multiple, creative solutions. There are no truly wrong answers.

ALIGNED WITH COMMON CORE

All lessons were aligned with the Common Core. In addition, a **grading rubric** is provided to help teachers evaluate student progress.

MOVE TO STUDENT-DRIVEN LESSONS

Begin With **Guided Inquiry**: build background knowledge of the topic before letting students take the reins in developing their own inquiry.

Teach Students How to Question: An important aspect of inquiry-based learning is *teaching students how to ask deeper questions*.

Encourage students to be creative problem solvers.

Let Your Students Drive Their Own Inquiry: what questions do students want to explore more?

That may or may not be something that the teacher envisioned. It really flips the classroom in the sense that the student is then in the driver seat.

ENCOURAGE QUESTIONS AND SUPPORT REFLECTION

Very often, Deaf and Hard of Hearing students do not get the same opportunities to participate in class discussions within the mainstream classrooms. These activities can be done in groups, or individually. We emphasize that instructors are to encourage questions and support reflection on the part of the Deaf or Hard of Hearing student.

We want to encourage students to really think and try out ideas, develop hypotheses and see what they can come up with.

PRIMARY GOALS

Goal 1: To date there exists no STEM based curriculum designed specifically for Deaf and Hard of Hearing Students. Our goal is to *start* the development of such specialized curricula.

Goal 2: Increase educators' abilities to teach introductory STEM concepts specifically to Deaf and Hard of Hearing students.

Goal 3: Support the development of schools and out of school time programs in the U.S. that include STEM-related instruction to Deaf and Hard of Hearing students.

Goal 4: To give Deaf and Hard of Hearing students the tools they need to transition from high school to college and into a career in the STEM fields.

INSTRUCTIONAL APPROACH

Yes, this curriculum is aligned with the Common Core.

All lessons were aligned with the Common Core. In addition, a **grading rubric** is provided to help teachers evaluate student progress.

Most important – the move from Teacher-Guided to Student-Driven lessons:

Begin with **Guided Inquiry**:

Teacher-guided inquiry can build background knowledge of the topic before letting students take the reins in developing their own inquiry. With guided inquiry:

- Teachers start with an overall guiding question.
- Teachers know what they want their students to understand beforehand.
- Students know what the outcome of the inquiry will be.

Teach Students How to Question:

Explore and Model Different Types of Deeper-Level Questions

An important aspect of inquiry-based learning is *teaching students how to ask deeper questions*. Two tips help teachers:

- Across grade levels, reflect on how you model questioning from Middle School and up.
- Pose big questions that don't necessarily have a single answer -- or any answer.

Encourage students to be creative problem solvers. For example, if students are reviewing a video or reading a text and are posing questions about how they are related there might not be only one answer. As you start to pose those questions, we're hoping that students start to pose those questions for themselves in a way that they can create an inquiry. *Teachers are guiding with higher-level questions to really get students thinking and learning how to question themselves*.

Let Your Students Drive Their Own Inquiry:

In the guided inquiry example of STEM in sports, the teacher knows that she wants students to understand the science involved in sports. She creates a question that will guide students to an outcome already known to them (e.g., let's kick a soccer ball outside and measure how far it will go).

The *student-driven inquiry* is what happens after the guided inquiry. Having learned STEM concepts in math or science classes, what questions do students want to explore more? Their inquiry questions might be:

- How is math used to improve a soccer kick or goal stats?
- What kind of technology helps athletes improve their running skills?

Whatever it is that they're wondering about, that's the student-driven piece. That may or may not be something that the teacher envisioned. It really flips the classroom in the sense that the student is then in the driver seat.

Finally, remember that today's generation of learners are computer natives; meaning this generation has had technological opportunities from birth. Even those children with limited access to technology at home, have had more exposure to computers and technology than generations past. Students today are naturals at exploring the Internet and comfortably learning my trial and error. Many of the following lessons start "unplugged" (i.e., not requiring a computer) but all rapidly move to websites that children can explore. The authors have taken the time to identify only websites that are Deaf friendly and accessible. Please enjoy!

COMMON CORE CONNECTION

Grades 6-8: Science and Technical Subjects

KEY IDEAS AND DETAILS

CCSS.ELA-LITERACY.RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts.
CCSS.ELA-LITERACY.RST.6-8.2	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
CCSS.ELA-LITERACY.RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

CRAFT AND STRUCTURE

CCSS.ELA-LITERACY.RST.6-8.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8 texts and topics*.
CCSS.ELA-LITERACY.RST.6-8.5	Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.
CCSS.ELA-LITERACY.RST.6-8.6	Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.

INTEGRATION OF KNOWLEDGE AND IDEAS

CCSS.ELA-LITERACY.RST.6-8.8	Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.

CCSS.ELA-LITERACY.RST.6-8.9	Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

RANGE OF READING AND LEVEL OF TEXT COMPLEXITY

CCSS.ELA-LITERACY.RST.6-8.10	By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.

Grades 9-10: Science and Technical Subjects

KEY IDEAS AND DETAILS

CCSS.ELA-LITERACY.RST.9-10.1	Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
CCSS.ELA-LITERACY.RST.9-10.2	Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
CCSS.ELA-LITERACY.RST.9-10.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

CRAFT AND STRUCTURE

CCSS.ELA-LITERACY.RST.9-10.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9-10 texts and topics*.
CCSS.ELA-LITERACY.RST.9-10.5	Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*).

CCSS.ELA-LITERACY.RST.9-10.6	Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.

INTEGRATION OF KNOWLEDGE AND IDEAS

CCSS.ELA-LITERACY.RST.9-10.7	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
CCSS.ELA-LITERACY.RST.9-10.9	Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

RANGE OF READING AND LEVEL OF TEXT COMPLEXITY

CCSS.ELA-LITERACY.RST.9-10.10	By the end of grade 10, read and comprehend science/technical texts in the grades 9-10 text complexity band independently and proficiently.

Grades 11-12: Science and Technical Subjects

KEY IDEAS AND DETAILS

CCSS.ELA-LITERACY.RST.11-12.1	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
CCSS.ELA-LITERACY.RST.11-12.2	Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

CRAFT AND STRUCTURE

CCSS.ELA-LITERACY.RST.11-12.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11-12 texts and topics*.

CCSS.ELA-LITERACY.RST.11-12.5	Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.
CCSS.ELA-LITERACY.RST.11-12.6	Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.

INTEGRATION OF KNOWLEDGE AND IDEAS

CCSS.ELA-LITERACY.RST.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
CCSS.ELA-LITERACY.RST.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
CCSS.ELA-LITERACY.RST.11-12.9	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

RANGE OF READING AND LEVEL OF TEXT COMPLEXITY

CCSS.ELA-LITERACY.RST.11-12.10	By the end of grade 12, read and comprehend science/ technical texts in the grades 11-CCR text complexity band independently and proficiently.

LINKS TO THE STANDARDS

NATIONAL COMMON CORE STANDARDS	CALIFORNIA COMMON CORE STANDARDS
NEXT GENERATION SCIENCE STANDARDS	NATIONAL SCIENCE EDUCATION STANDARDS
NCTE / IRA STANDARDS FOR ENGLISH LANGUAGE ARTS	McREL STANDARDS AND BENCHMARKS (LIFE SKILLS)

SUGGESTED RUBRIC [MS/HS]

Each STEM activity has a central idea that students can explore. Grades are based on the complexity and depth of response.

	(Excellent) 4	(Good) 3	(Satisfactory) 2	(Needs Improvement) 1
Level of engagement in class	Student engaged and challenged by the activity and offers ideas or asks questions more than once per class.	Student engaged and challenged by the activity and offers ideas or asks questions once per class.	Student rarely engaged and challenged by the activity and rarely offers ideas or asks questions.	Student never engages in class, offers ideas or asks questions.
Student identifies a question about their chosen STEM area.	Student clearly self identifies one or two questions for exploration.	Student clearly self identifies one question for exploration.	With help, student identifies one question for exploration.	Even with help student is not able to identify a question (one is therefore assigned).
Student cites resources in answering his / her question.	Student synthesizes information from four or more resources.	Student synthesizes information from three resources.	Student synthesizes information from two resources.	Student synthesizes information from only one resource.
Content of presentation.	Shows a full understanding of the topic.	Shows a good understanding of the topic.	Shows a good understanding of parts of the topic.	Does not seem to understand the topic very well.
Creativity of presentation.	Presentation is a complete project (vlog, video, PowerPoint or Essay) with ample multiple citations and creative answers to original question.	Presentation is a complete project (vlog, video, PowerPoint or Essay) with several citations and creative answers to original question.	Presentation is a complete project (vlog, video, PowerPoint or Essay) with at least one citation and one creative answer to original question.	Presentation is an incomplete project with few, if any, citations and no creative answers to original question.
Scholarly.	Includes analysis or synthesis of researched materials and own experience. Thoughtful, academic and stimulating. Pertinent to the assigned topic and clear.	Usually includes analysis of synthesis of researched materials and own experiences. Pertinent to the assign topic and represents original thought.	Significant amount of material copied from resources without condensing through analysis or synthesis. Presentation includes off-topic materials.	No evidence of cognitive processing of STEM resources or analyzing own experience. Presentation is not directly relevant to assignment.
Clarity, Grammar, (for written work) spelling, (for video work) register of ASL used.	No errors. Statements always clear and comprehensible.	A few errors that do not impede understanding.	Some errors that may impede understanding.	More than four errors than impede understanding.
Students utilize and document the web sites used to determine what resources are available when researching different STEM careers.	Student use two to three web sites to determine what resources are available when researching different STEM careers.	Student use one web site to determine what resources are available when researching different STEM careers.	With help, student uses one web site to determine what resources are available when researching different STEM careers.	Even with assistance, student is not able to use any websites to determine what resources are available when researching different STEM careers (a student is therefore assigned).