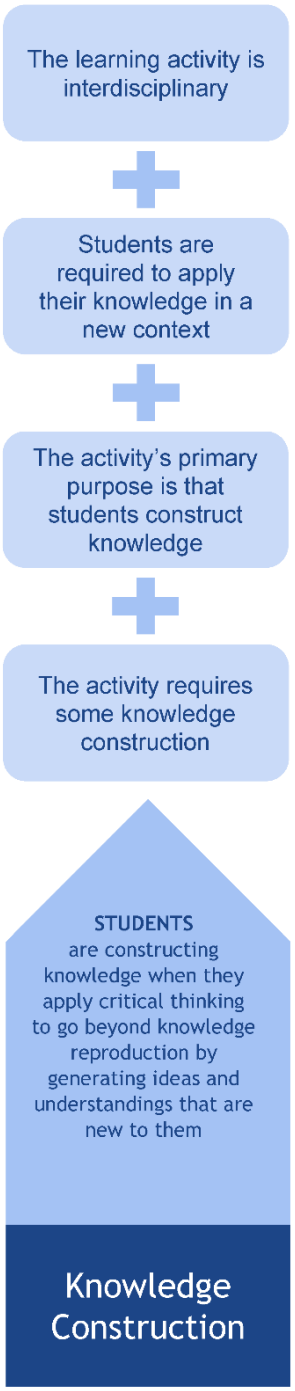

BECOMING A CRITICAL THINKER THROUGH KNOWLEDGE CONSTRUCTION

Parts of this guide are attributable to Microsoft Partners in Learning

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Knowledge Construction

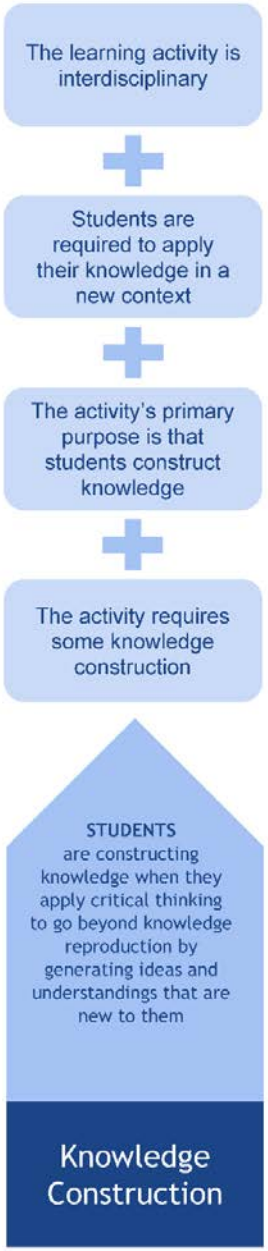
Hear and I forget. I see and I remember. I do and I understand.
- Chinese Proverb

You don't understand anything until you learn it more than one way.
- Marvin Minsky

Do not confine your children to your own learning for they were born in another time.
- Hebrew Proverb

Education needs to be geared toward the **HANDLING** of data rather than the**ACCUMULATION** of data.
- David Berlo

Students are constructing knowledge when they apply critical thinking to go beyond knowledge reproduction by generating ideas and understandings that are new to them



Why students should construct knowledge

Many have referred to the modern world economy as a "knowledge economy," in which the possession of knowledge is far less important than the creative uses of knowledge. In this knowledge economy, the development of new knowledge is the greatest driver of innovation. In fact, most living-wage jobs today demand content-area expertise, but also the ability to apply knowledge to new situations and new problems.

More than at any other time in history, knowledge is at our fingertips, especially through Internet-connected mobile computing devices and smartphones. And while the Internet is not all-knowing, it is indisputable that virtually any fact, figure, procedure, or resource can be located almost instantly by just about anyone.

Teaching students for mere recall of facts and mastery of procedures therefore seems a narrow outcome for twelve years of schooling. Preparing students with knowledge, and the ability to construct further knowledge through critical and applied thinking (what some call deep learning), is a key feature of the NVACS, and will better position our students as productive contributors to a knowledge economy.

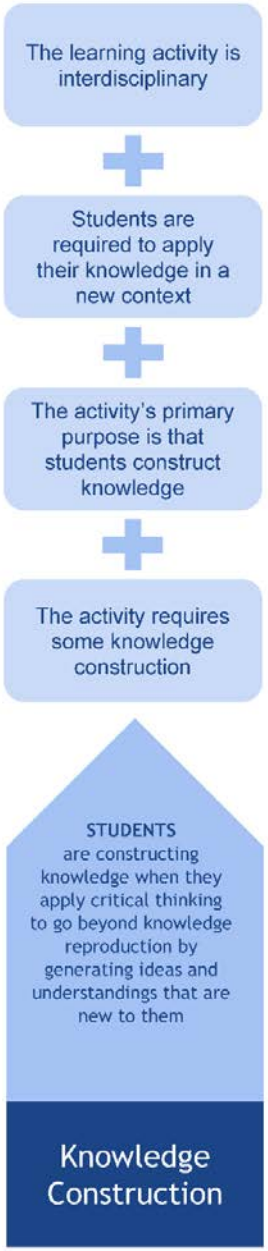
What is knowledge construction?

The generation, or thoughtful creation, of new ideas and understandings lies at the heart of knowledge construction. By focusing on the process of creating ideas and carefully considering their value, we can become more skilled at thinking critically and creatively. But, how do students thoughtfully create, or generate, new understandings? And how can we expect our students to regularly come up with new ideas?

In the context of learning, it is important that we think of "new" ideas and understandings as those that are "new to me" (just as when I purchase a pre-owned vehicle it is "new to me"). When we encourage students to generate new ideas, we are not concerned with how earth-shattering the ideas are; we are far more interested in the process by which students generate these ideas. For instance, a student who has created and tested a mathematical strategy is far more likely to have developed a deep, transferable understanding than a student who has observed a few worked solutions and completed the odd-numbered problems on page 413. Knowledge construction cannot be achieved when students merely reproduce what they have already learned.

How to plan instruction that includes opportunities for students to construct knowledge

If knowledge construction is a process by which students generate ideas and understandings, the focus of classroom instruction should be on helping students to learn and experience this process. Learning activities that are higher on the knowledge construction *elevator*, on the right of this



page, give students more opportunity to construct ideas, connect them to other content, and internalize understandings.

Activities that require students to generate ideas typically include one (or more) of the following:

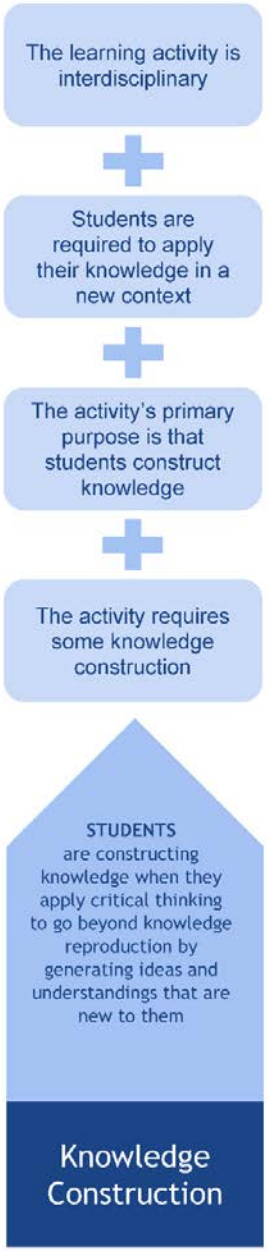
- **Interpretation** – means drawing inferences beyond the literal meaning. For instance, students might read a description of a historical period and infer why people who lived then behaved as they did.
- **Analysis** – means identifying relationships among the parts of a whole. Students might investigate local environmental factors to determine which are most likely to affect migrating birds.
- **Synthesis** – means identifying the relationships among two or more ideas. Students might compare and contrast perspectives from multiple sources.
- **Evaluation** – means judging the quality, credibility, or importance of data, ideas, or events. Students might read several accounts of an event to determine which they find most credible.

Table 2a. Generating new ideas and understandings

Interpretation Drawing inferences beyond the literal meaning	**Analysis** Identifying relationships among the parts of a whole
Synthesis Identifying relationships among multiple ideas	**Evaluation** Judging quality, credibility, or importance

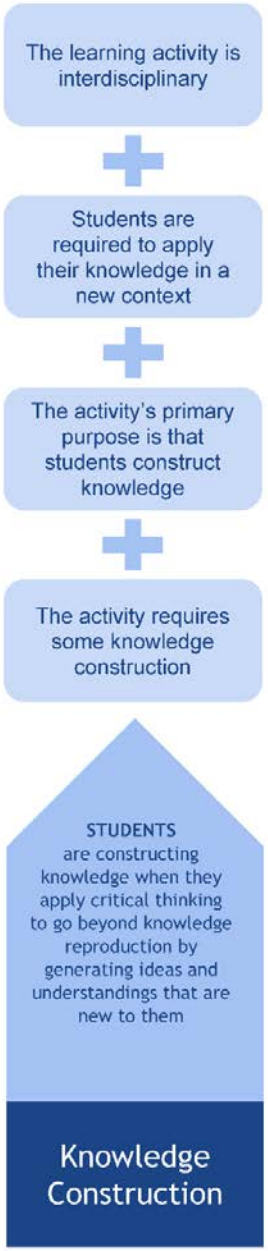
Importantly, the generation of new ideas and understandings cannot be achieved by following procedures students already

A NOTE ON "RESEARCH": Students commonly conduct research in preparation for creating a product of learning, such as an essay or poster. To instill in students the value of knowledge construction and critical thinking as essential components of the research process requires more than reproducing existing information. True research is a process of knowledge construction, which requires some combination of interpretation, analysis, synthesis, and evaluation.



know. When an activity requires students to devise procedures themselves, the activity qualifies as knowledge construction.

Turning to the four levels on the knowledge construction *elevator* will help us identify how to build opportunities for knowledge construction and critical thinking into instruction, and engage students in their development of the 21st Century competency of knowledge construction.



The activity requires some knowledge construction

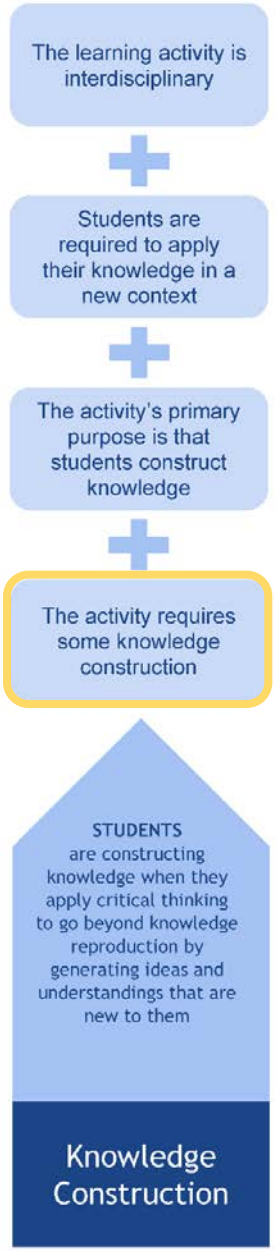
An activity requires some knowledge construction when students go beyond reproducing knowledge to generate ideas or understandings that are new to them.

Key considerations:

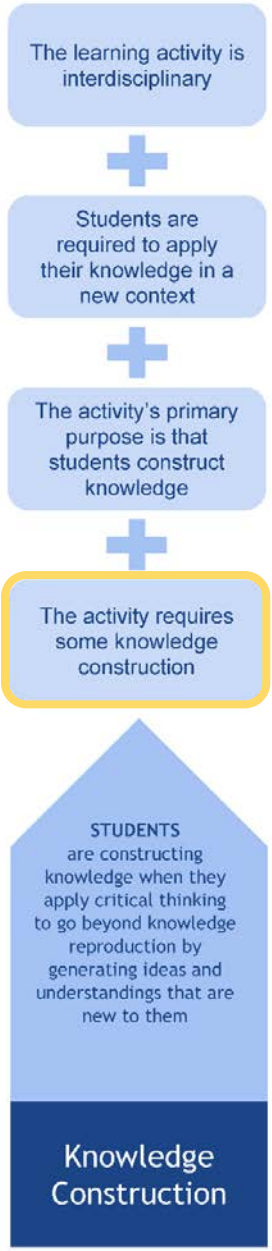
- Most activities that require some knowledge construction ask students to interpret, analyze, synthesize, or evaluate information or ideas.
- Most activities that require some knowledge construction ask students to devise procedures for conducting their own work. Practicing procedures students already know, or following a prescribed set of steps does not qualify as knowledge construction.

Consider the learning activities in this table. Identify if each is an example of requiring some knowledge construction.

Does this activity require some knowledge construction?	
No	**Yes**
Students write a paper describing the crime a character committed. *Students are merely describing information they have collected.*	**Students use details in a story to infer the reasons why a character committed a crime.** *Students are using inferences to go beyond the literal information they have collected to construct an argument about why a character behaved a certain way.*
Students search the Internet for several YouTube videos showing different ways to solve a mathematical problem, then write a description of each method. *Students are only describing information they have collected.*	**Students search the Internet for several YouTube videos showing different ways to solve a mathematical problem, then write a paper comparing and contrasting the merits of each method.** *Students are collecting information, and evaluating the information by constructing a judgment of its relative merits.*



Does this activity require some knowledge construction? (continued)	
No	**Yes**
Groups of students follow a set of written instructions to build a tissue-paper balloon in preparation for a school-wide launch. *Students are following a pre-existing process, which they cannot modify.*	**Groups of students are given a set of criteria for a finished tissue-paper balloon, and access to an Internet search engine, in preparation for a school-wide launch.** *Students are given the criteria for a finished product, but are required to develop a creative process for achieving the end result.*



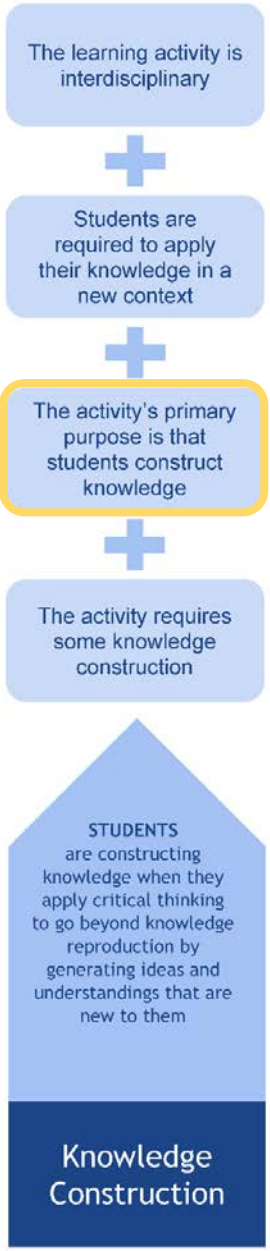
The activity's primary purpose is that students construct knowledge

An activity's primary purpose is knowledge construction when students go beyond reproducing knowledge to generate ideas or understandings that are new to them, AND the main requirement of the activity is the construction of knowledge through interpretation, analysis, synthesis, and/or evaluation.

Key considerations:

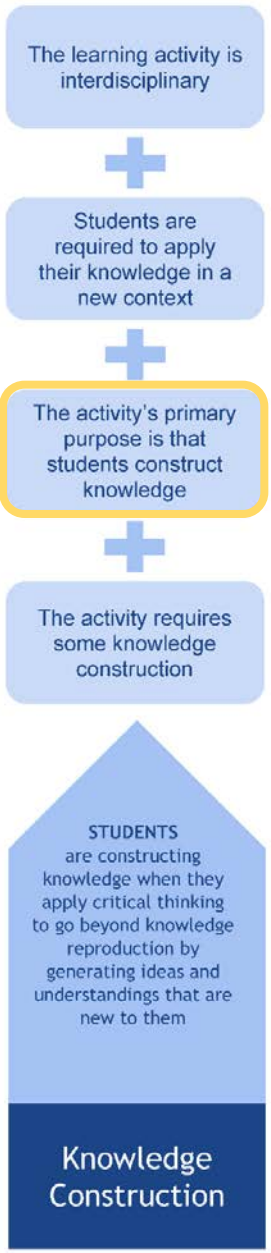
- When determining if an activity's primary purpose is knowledge construction, students' *time* and *effort* should be considered.
  - Time: most of a student's time should be spent on generating new ideas or understandings.
  - Effort: most of a student's effort should be spent on generating new ideas an understandings, and this should be evident in any product of learning.
- The following actions of the teacher should also be considered when determining if an activity's primary purpose is knowledge construction.
  - Coaching students through their development of learning processes, rather than providing answers.
  - Incorporating the generation of ideas into expectations and grading.
  - Establishing classroom environments that activate feedback from many different sources.

STRATEGY: Rubrics that specifically include 21st Century competencies can be a great way to ensure students are focusing on the process of constructing knowledge, rather than merely learning the content.



Consider the learning activities in this table. Identify if each is an example of an activity's primary purpose being that students construct knowledge.

Is the activity's primary purpose that students construct knowledge?	
No	**Yes**
Students spend a class period conducting a close read of a scientific article on bear habitats. For homework students write a paragraph drawing an inference about local bear behavior during the present drought. *Although the homework asks students to interpret the article by drawing inferences, the time spent constructing knowledge is minimal compared to the time taken understanding concepts in the article through the close read.*	**After previously conducting a close read of a scientific article on bear habitats, students spend three class periods preparing for a debate on the topic of local efforts to reduce bear depredations.** *Most time is spent analyzing bear behavior in the context of local conditions, and synthesizing and evaluating information to construct an argument.*
Students complete a unit test focused on the acquisition of content knowledge. *A content-focused test does not demonstrates only that students can reconstruct existing understandings.*	**Students are graded on a portfolio of work in which 50%+ of their grade is earned through demonstration of their activities interpreting, analyzing, synthesizing, and evaluating information.** *Students are demonstrating that most of their time and effort was spent constructing knowledge rather than learning or processing knowledge and processes that were presented to them.*



Students are required to apply their knowledge in a new context

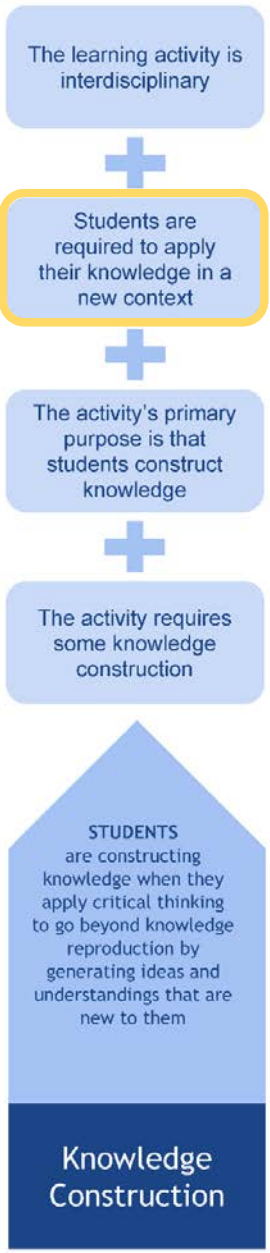
Students apply their knowledge when they use knowledge they have constructed to support another knowledge construction task in a new context. The second task deepens students' understanding of content because they must apply their understanding in a different situation. Students must consider their knowledge and ideas from a different point of view—leading to transfer of learning and abstract thinking.

Key considerations:

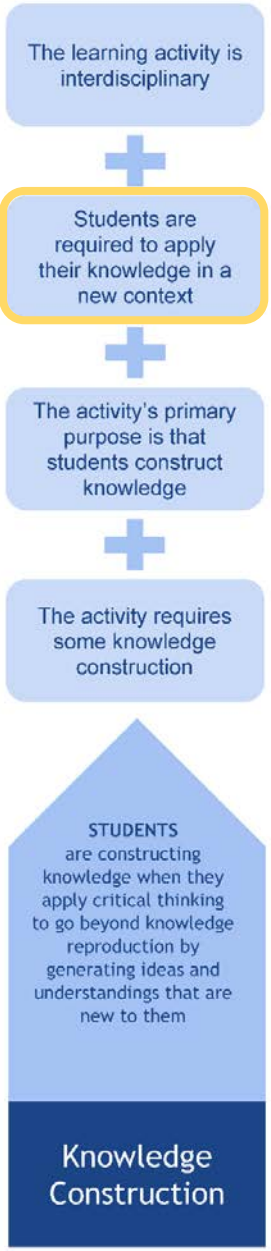
- To qualify as a new context, the two contexts must differ substantially from each other. For instance, students who constructed knowledge about the principles of heat by studying the Earth's core might apply this new knowledge to a study of Jupiter.
- To qualify as an application of knowledge, students should apply knowledge in a different way in the new context. For example, students might write a persuasive essay for an academic audience, then use their constructed knowledge about persuasion to re-write the article as a newspaper column for a general audience.

Consider the learning activities in this table. Identify if each is an example of students being required to apply their knowledge in a new context. (Note: To qualify as *applying knowledge in a new context*, the learning activity must also meet all the requirements of *constructing knowledge*.)

Are students required to apply their knowledge in a new context?	
No	**Yes**
Students analyze demographic statistics from their hometown and then analyze demographic statistics from a second location. *Students do not apply their knowledge from analyzing demographic statistics to any new activity; they simply repeat the same activity with a different set of data.*	**Students analyze demographic statistics from their hometown and then use their understanding of population trends to develop a plan for an upcoming housing development project.** *Students apply their knowledge from analyzing demographic statistics in order to develop a housing plan; this step requires further analysis.*



Are students required to apply their knowledge in a new context? (continued)	
No	**Yes**
Students examine photos enlarged at different sizes to develop an understanding of similarity and then describe their understanding. *Students do not apply their knowledge from evaluating shapes to any new domain; they simply articulate that knowledge.*	**Students examine photos enlarged at different sizes to develop an understanding of similarity and then apply that knowledge to abstract geometric shapes, thinking about size ratios and angles to determine which shapes are mathematically similar.** *Students apply their knowledge from evaluating shapes to deepen their own understanding of mathematical similarity.*
Students in drama class analyze the characters in a play to learn about character development and then write an essay about what they learned. *Students do not apply their knowledge from their character analysis to any new task; they simply articulate that knowledge.*	**Students in drama class analyze the characters in a play to learn about character development, then use a digital camera and Movie Maker to create their own one act play demonstrating character development.** *Students apply their knowledge from their character analysis to create and develop their own characters; this step requires further interpretation and analysis.*
Students design and execute a procedure for testing the qualities of the tap water at their school. Students conduct the test, then redesign the procedure iteratively until they have accurate data. *Although students apply their knowledge from previous trials to refine the procedure, they are only applying knowledge within a single (repeated) context. They are deepening their knowledge, but not extending it to a new type of application.*	**Students design and execute a procedure for testing the qualities of the tap water at their school. Once they have accurate data, they use that information to determine which water filtration system would be most appropriate for the school.** *Students apply their knowledge from designing and conducting water quality tests to select an appropriate water filtration system, which forces them to look at what they have learned in a new way and deepen their knowledge.*



The learning activity is interdisciplinary

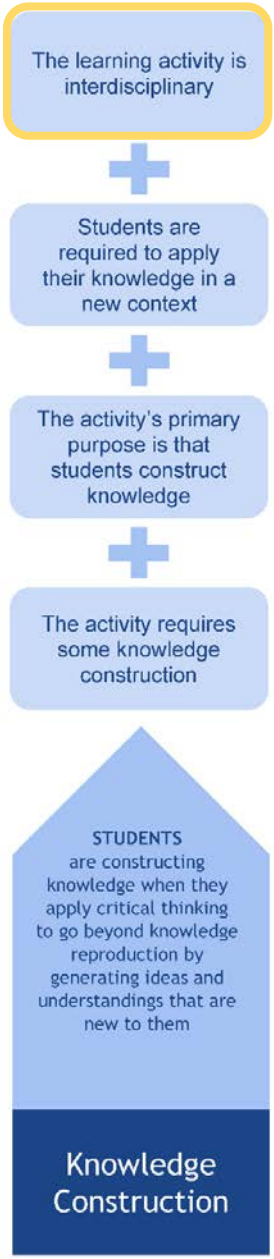
Interdisciplinary learning activities have clear learning goals that incorporate content, ideas, and methods from multiple academic subjects.

Key considerations:

- To qualify as interdisciplinary, the activity must include substantial content, ideas, and/or methods from at least two academic disciplines.
- Assessment processes, including formative processes such as ongoing feedback, should focus on at least two academic disciplines.
- Clear learning goals from at least two academic disciplines should be communicated to students.

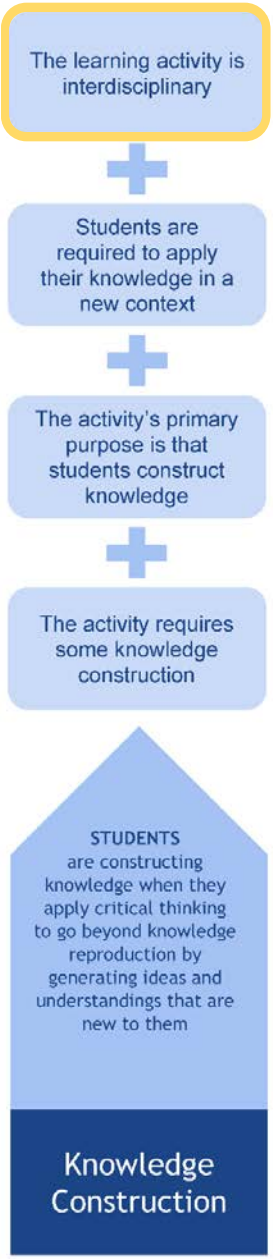
Importantly, interdisciplinary activities must require students to apply constructed knowledge in new settings in at least two academic disciplines.

REALITY CHECK!
Interdisciplinary activities can be highly rewarding as a teacher, but quite time consuming and difficult to plan. Start small, identifying logical connections between only two disciplines—like asking students to use a chart to represent pertinent demographic information in a history essay.



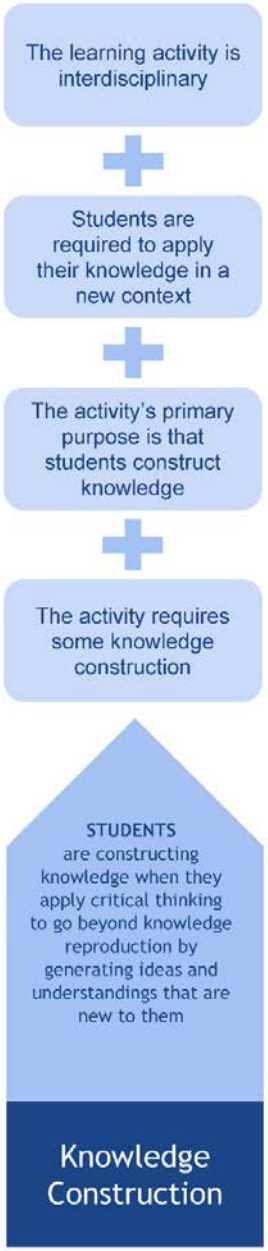
Consider the learning activities in this table. Identify if each is an example of an interdisciplinary learning activity.

Is the learning activity interdisciplinary?	
No	**Yes**
Students in science class conduct an experiment to determine the effects of different watering practices for local trees. Students then write persuasive letters to the City Council suggesting changes to current policies. Students are given a rubric for their experiments in advance, and graded according to this rubric. *Students are only given success criteria (in this case a rubric) for one discipline.*	**Students in science class conduct an experiment to determine the effects of different watering practices for local trees. Students then write persuasive letters to the City Council suggesting changes to current policies. Students are given rubrics for their experiments, and for their persuasive letter, in advance, and graded according to both rubrics.** *Students are given success criteria (rubrics) for two disciplines, and must demonstrate knowledge construction in both. (This activity also meets the requirements of* applying knowledge in a new context *because students are using their constructed knowledge of watering practices in the new context of using this constructed knowledge to influence public policy.)*
Students research the countries of a world region and collect information about each country's climate, economy, and culture. Students then create and publish a visitor's guide for each country on a *Weebly* website. *Students do not have success criteria from multiple disciplines and are reproducing, rather than constructing knowledge.*	**Students research the countries of a world region and evaluate the importance of different types of quantitative and qualitative information useful to potential visitors to these countries. Students then synthesize their information to publish a visitor's guide for each country on a *Weebly* website. Students are provided with success criteria aligned to social studies, mathematics, and ELA standards.** *Again, students have success criteria from more than one discipline, and must demonstrate knowledge construction in each discipline. (Extension question: Is the creation of a website sufficient for students to demonstrate they are applying their knowledge of countries in a new context?).*



Final thoughts on knowledge construction

Activities that foster knowledge construction require students to use critical and creative thought processes to generate their own understanding. Allowing students some flexibility in the outcomes of their work, and the means they use to develop these outcomes, provides them with opportunities to develop and practice the thought processes that lead to the construction of knowledge. Virtually all work in the real world is interdisciplinary, requiring people to blend content knowledge and concepts from many disciplines to develop applications of knowledge in new contexts. Interdisciplinary learning activities therefore provide the greatest scope for students to develop the 21st Century competency of knowledge construction in preparation for their entry into an economy in which knowledge is a critical commodity.



Questions to ponder

1. Examine the Sample Learning Activity over the page to see how a collection of NVACS standards might be elevated through Knowledge Construction (read from bottom to top!). How do the student learning outcomes differ as the activity is modified to meet each Knowledge Construction competency?
2. What dispositions would an educator need to successfully facilitate an interdisciplinary learning activity where students construct their own knowledge?
3. How could technology be used by students to enhance knowledge construction activities?
4. In what ways might an educator formally and informally assess knowledge construction among students?
5. How might special needs students benefit from constructing their own knowledge during learning activities? What considerations should educators keep in mind?