
Online Resources to Support Academic & CTE Integration

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Academic & Vocational Integration Defined:

"to provide vocational education in programs that integrate academic and vocational education . . . so that students achieve both academic and occupational competencies." **Perkins Legislation**

Richer, better sequenced curricula that enhance academic and generic skills needed by all workers.

Increased collaboration and coordination among academic and vocational teachers to create a more unified schooling experience.

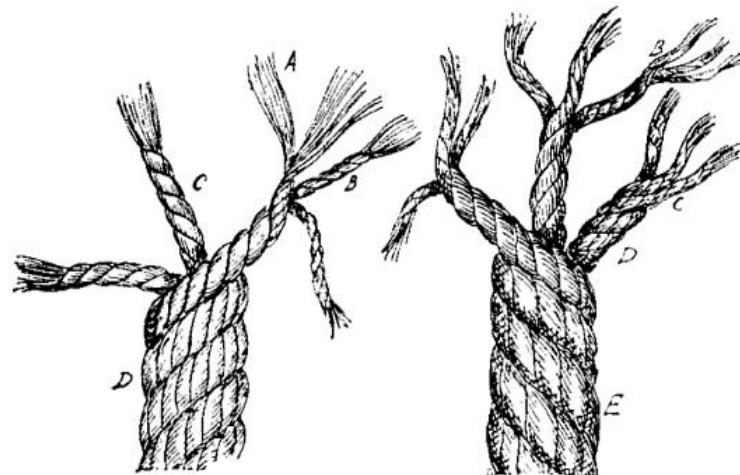


FIG. 1.—Construction of rope.

Why Integration?

NCLB

“....any program that is included in the school wide program, which may include -“(cc) the integration of vocational and technical education programs;”

Cherry Commission

“All students today must be equipped with rigorous academic preparation and high performance job skills”.

Perkins IV

“promote the development of services and activities that integrate rigorous and challenging academic and career and technical instruction...”.

Reasons to Integrate

- More highly educated workforce contributes to a healthy economy
 - More skills = increased adaptability as society changes.
 - Prevention of curriculum fragmentation
 - Stimulates higher levels of integrated thinking
 - Able to view complex issues from a broader perspective
 - Time savings by overlapping academic and vocational content
 - Integration is consistent with brain research and learning theory
 - Increased graduation requirements
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Reasons for Integration

- CTE has moved beyond working primarily with the hands only. All occupations required the use of hands and the head.



Research: Building Academic Skills in Context: Testing the Value of Enhanced Math Learning in CTE

An experimental study tested a model for enhancing mathematics instruction in five high school career and technical education (CTE) programs (agriculture, auto technology, business/ marketing, health, and information technology). The experimental teachers worked with math teachers in communities of practice to develop CTE instructional activities that integrated more mathematics into the occupational curriculum.

After 1 year of the math-enhanced CTE lessons averaging 10% of class time, students in the experimental classrooms performed significantly better on 2 tests of math ability—the TerraNova and ACCUPLACER®—without any negative impact on measures of occupational/technical knowledge.

Building Academic Skills in Context: Testing the Value of Enhanced Math Learning in CTE”, was completed in 2005

Research: Building Academic Skills in Context: Testing the Value of Enhanced Math Learning in CTE

Continued:

- After 1 year of exposure to the math-enhanced lessons, the students in the experimental classrooms performed significantly better on the TerraNova and ACCUPLACER tests of math ability.
 - They also performed better on WorkKeys, though the difference was not significant.
 - Furthermore, there were no differences in measures of occupational or technical knowledge—meaning that CTE students' math skills increased without detracting from the content skills learned in their CTE courses.
 - ..the improved math performance of the experimental students was produced by assembling teams of teachers in a single occupational area and providing them with a process and a pedagogy through which they could successfully enhance the math in their own curricula. Essential to the model was the ongoing teamwork between CTE instructors and their math partners in an authentic community of practice.
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Decisions:



Resources to Support Integration



Utilization of Online Resources

- Supplement Direct Instruction
 - Remediation
 - Absent Students – Makeup Work
 - Ease of Access
 - Real World Application
 - Broad Overview is Provided
 - Linkage to Learning Objects Produced by
 - (NSF, Federal Gov. Associations, Non-Profits, etc.)
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Simulations are Safer



Simulations

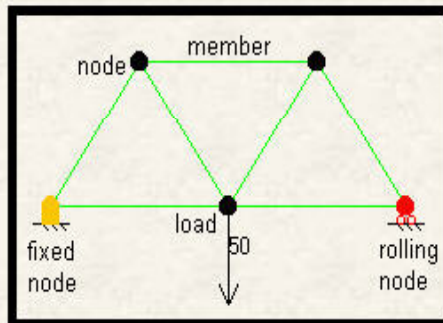
The screenshot shows the PBS Building BIG website interface. At the top, there are navigation links for PBS HOME, PROGRAMS A-Z, and TV SCHEDULES. Below this, there are links for Home, Site Map, Labs, Databank, and Glossary. The main navigation menu includes FORCES, LOADS, MATERIALS, and SHAPES. The current page is titled "Wood" and features a slider control for adjusting the material's properties, with "squeeze" on the left and "stretch" on the right. A central illustration shows two hands pulling on a wooden block. Below the slider, there are tabs for PROPERTIES, PROS+CONS, and APPLICATIONS. The PROPERTIES tab is active, showing "TYPE: Spruce (softwood)", "COST:" with a red bar, and "WEIGHT:" with a red bar. On the left side, there is a "CHOOSE ONE" menu with options: Wood, PLASTIC, ALUMINUM, BRICK, CONCRETE, REINFORCED CONCRETE, CAST IRON, and STEEL. A sidebar on the far left lists building types: Bridges, Domes, Skyscrapers, Dams, and Tunnels. At the bottom left, there is a link for "ABOUT THIS LAB".

Understanding Physical Issues in Building Design Simulation

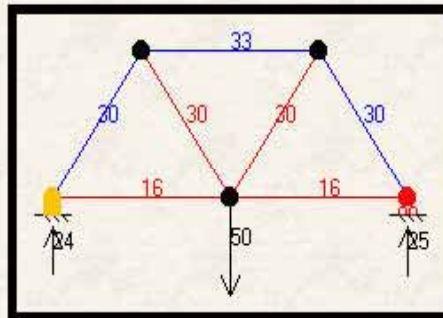
Bridge Design Simulator

Bridge Designer

Actually this program allows you design trusses. Trusses are composed of straight members connected at their ends by hinged connections to form a stable configuration. When loads are applied to a truss only at the joints, forces are transmitted only in the direction of each of its members. That is, the members experience tension or compression forces, but not bending forces. Trusses have a high strength to weight ratio and consequently are used in many structures, from bridges, to roof supports, to space stations.

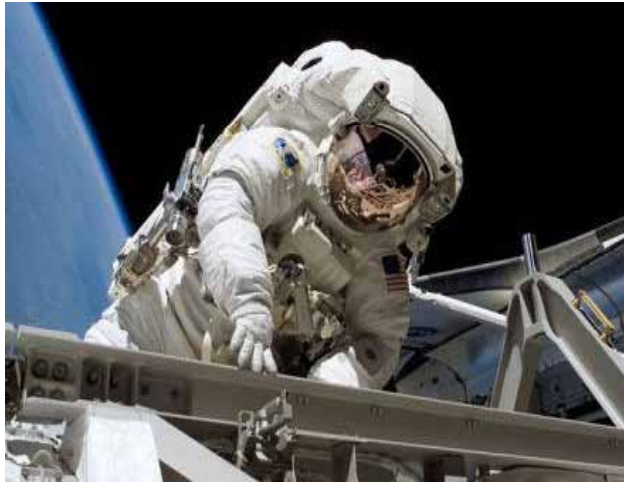


In this simulation, trusses are created by attaching members to nodes (joints). First, nodal locations are specified; then the nodes are linked by members to create a structure. Once the structure is established, two of the nodes must be assigned as support nodes. One must be a "fixed" node, i.e., one that can provide support in both the x- and y-directions; the other must be a "rolling" node, one that can provide support in only the y-direction. Finally, one or more nodes can be assigned to bear loads.



Once these elements are specified, a click on "Calculate" will check your design. Another click will generate a complete force diagram showing compression/tension forces in each of the members and reactive forces at the support nodes.

Present Day Construction Projects

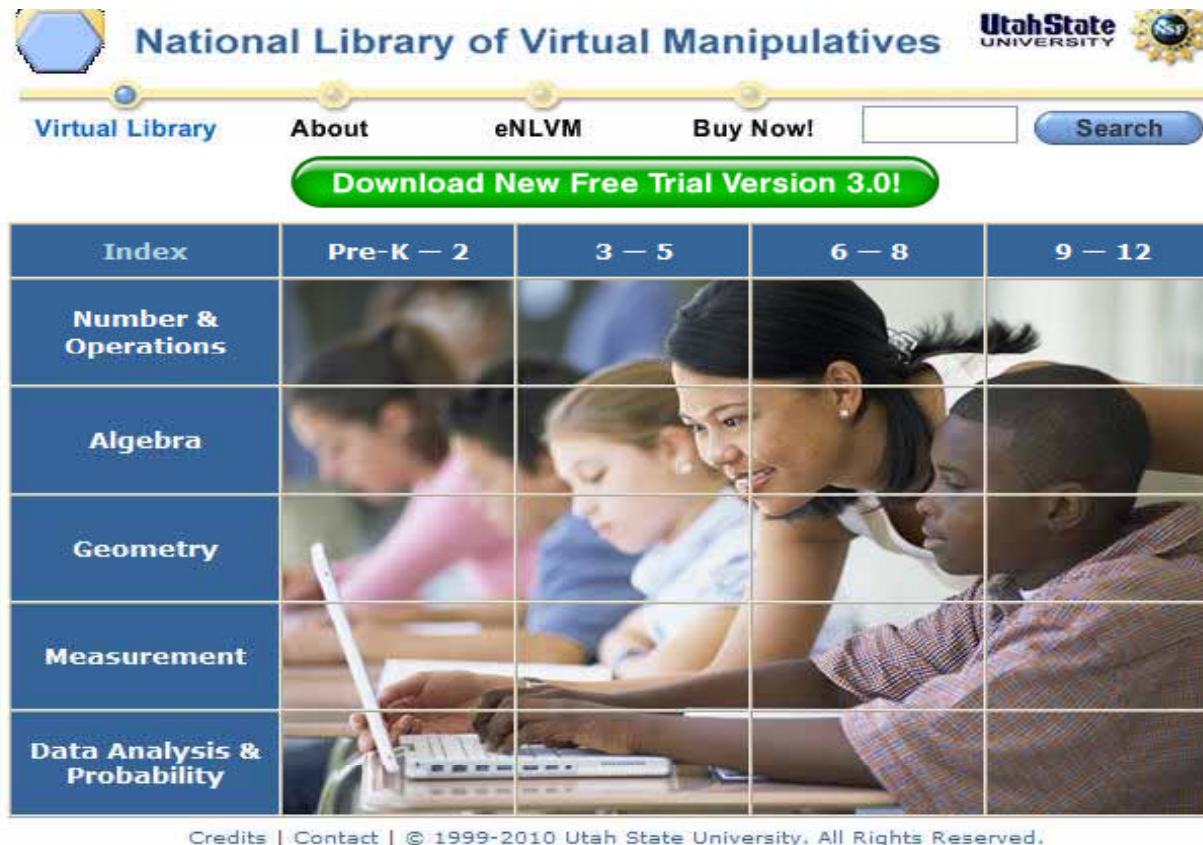


Cooking Simulations



<http://diehardgamefan.com/2009/11/09/review-food-network-cook-or-be-cooked-wii/>

National Library of Virtual Manipulatives



The screenshot shows the website's header with the title "National Library of Virtual Manipulatives" and the Utah State University logo. Below the header is a navigation bar with links for "Virtual Library", "About", "eNLVM", and "Buy Now!". A search box and a "Search" button are also present. A prominent green button reads "Download New Free Trial Version 3.0!". The main content area features a grid with a blue sidebar on the left containing categories: "Index", "Number & Operations", "Algebra", "Geometry", "Measurement", and "Data Analysis & Probability". The grid's columns are labeled "Pre-K - 2", "3 - 5", "6 - 8", and "9 - 12". The background of the grid is a photograph of students in a classroom using laptops.

Index	Pre-K - 2	3 - 5	6 - 8	9 - 12
Number & Operations				
Algebra				
Geometry				
Measurement				
Data Analysis & Probability				

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<http://nlvm.usu.edu/>

Simulation and Scenario Building Software

Make your training more interactive with Raptivity Tu

Simulations TurboPack

Immersive Learning Situations, Guided Adaptive Scenarios, Explorative Branching Simulations

This optional Simulations TurboPack contains 12 interaction models that enhance learning interactivity.

Simulate real-life learning experiences using award-winning Raptivity's scenarios, explorative branching simulations, immersion learning situations.



Adaptive Scenario with Picture



Explorative Immersive Learning Situation

- <http://www.raptivity.com/simulation-turbopack.html?gclid=CLTfn86yu58CFQwNDQodtXf3lw>

Web-Based Simulations for Math & Science

- Math and Science Simulations
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Videos

- [Expert Village](#)
- [America's Career Infonet Video's](#)
- [Teacher Tube](#)



Internet Based Resources: Math

1. [Math on the Job - How you use Math at Work](#)
2. [Math Use on the Job Videos](#)
3. [Math Use and Examples in Careers](#)
4. [Industry Examples of Academic Content](#)



Internet Based Resources: Math

- PlanetMath.org -- open math encyclopedia
- [Eric Weisstein's Mathworld](http://EricWeisstein.com) -- an extensive collection of mathematical theorems and formulas.
- S.O.S. Math - math tables, explanations, examples, and bulletin board.
- [Ask Dr. Math](http://AskDr.Math) -- the question answerer.
- Math.com- general math resources
- [The Math Forum](http://TheMathForum) -- many good math resources organized by subject, plus an extensive archive on commonly-asked questions.
- [The Math Archives](http://TheMathArchives) -- lesson plans, software, resources, and web-sites for K-12 math education.
- AmericaTakingAction.com. - other math resources
- [Manipula Math with Java](http://ManipulaMathWithJava) -- over one hundred graphical JAVA applets that demonstrate mathematical concepts (elementary to calculus).
- QuickMath - solves college and high school problems automatically
- Calc101.com - does derivatives and integrals, with each step explained
- [A Resource Guide to Algebra](http://AResourceGuideToAlgebra)



Internet Based Resources: Math

[List of Math Help](#)

[Number Notation](#)

[Addition Table](#)

[Multiplication Table](#)

[Fraction-Decimal Conversion](#)

[Interest](#)

[Units & Measurement Conversion](#)

1835 B.C. Math
Calculations



Internet Based Resources: Algebra

Linear Algebra

Basic Identities

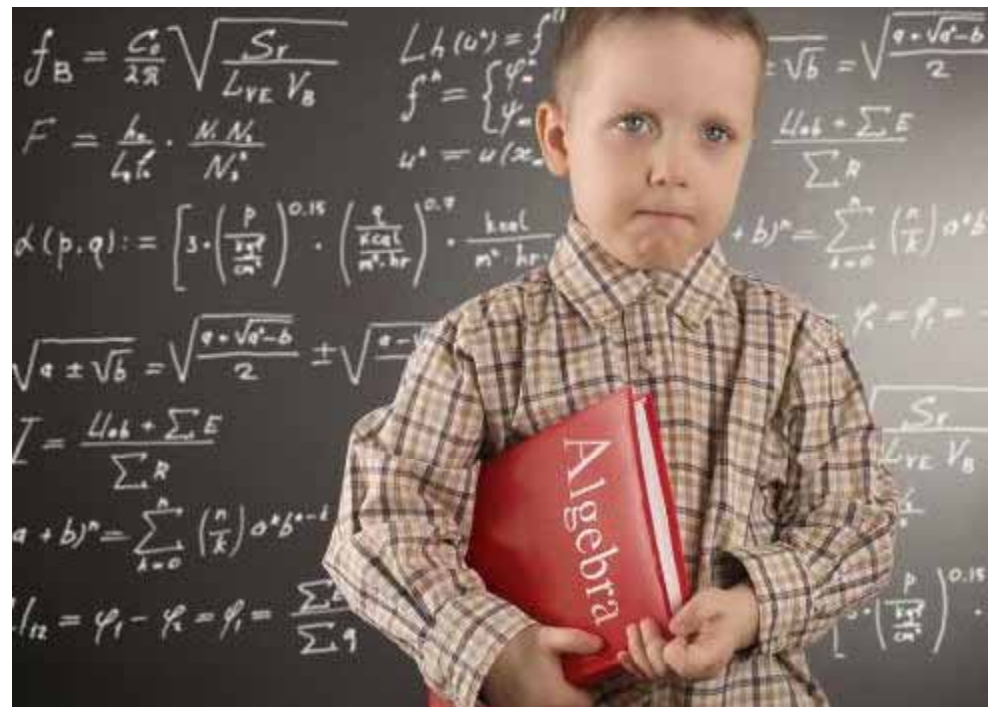
Conic Sections

Polynomials

Exponents

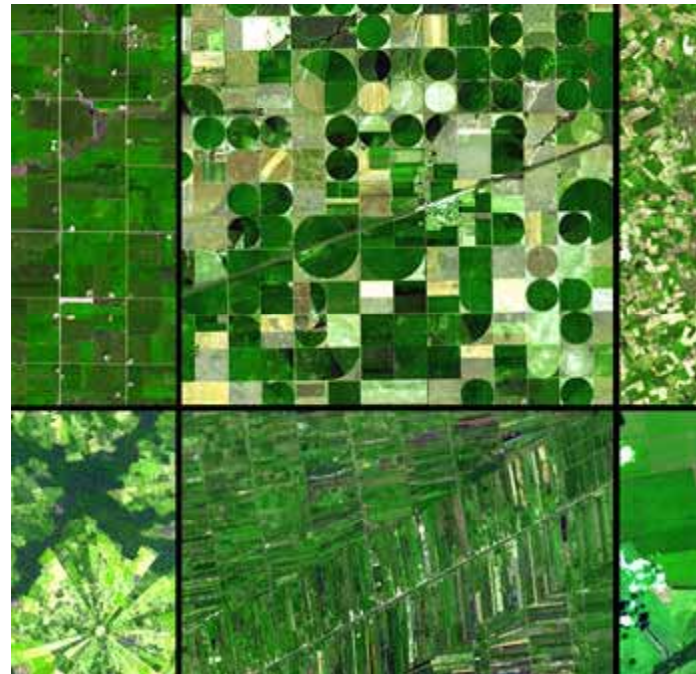
Algebra Graphs

Functions



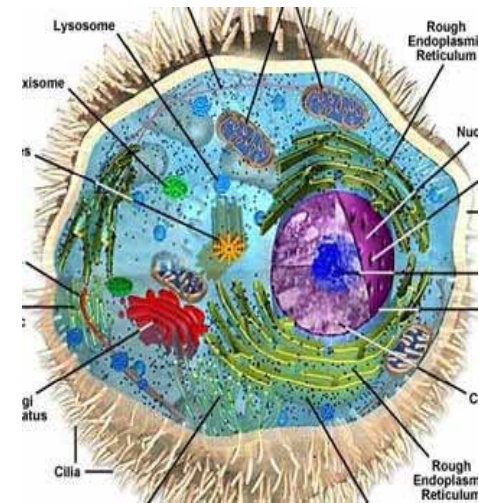
Internet Based Resources: Geometry

- [Geometry and Math References](#)
- [CAD Points of View](#)
- [Inca Geometry](#)
- [Volume of a Cylinder](#)
- [Surface Area of a Cylinder](#)
- [Volume of a Cube](#)
- [Linear Geometry](#)
- [Volume and Area Formulas](#)



Internet Based Resources: Biology

- [Amphibian Embryology Tutorial](#)
- [Cat Anatomy Tutorial](#)
- [Classification of Living Things Tutorial](#)
- [Discovering Mammals](#)
- [Dissection of Sheep's Brain Tutorial](#)
- [How to Become a Gardener](#)
- [Insect Biology and Ecology](#)
- [Landscape Irrigation Tutorials](#)
- [Natural History Online Book](#)
- [Oceans Deep - Exploring the Oceans](#)
- [Plate Tectonics](#)
- [Zoonotic Diseases Tutorials](#)
- [Here Comes the Sun - Solar Terrestrial Tutorial](#)



Internet Based Resources: Science

[About Electricity](#)

[AC Circuits – Hyper Physics](#)

[AC DC - What's the Difference](#)

[Atoms Family](#)

[Basics of Electrical Safety](#)

[Capacitance](#)

[CodeQuiz NEC](#)

[Copper Wire Chart – AWG](#)

[Current Electricity](#)

[Current Electricity Introduction - PDF](#)

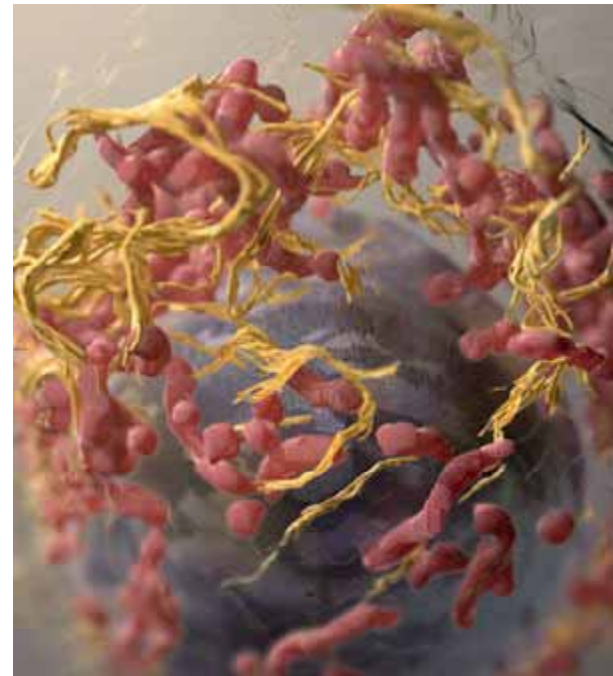
[DC Circuits](#)

[DC Circuits - Hyperphysics](#)

[Direct Current](#)

[Electric It and Magnetism Modules](#)

[Electric Charge](#)



Internet Based Resources: Science

[Ampere, Andre](#)

[Discovery of the Atom - A Look Inside](#)

[Edison, Thomas](#)

[Edison Museum](#)

[Electrical Inventors](#)

[Electricity and Magnetism - Historical Beginnings](#)

[Electron Discovery](#)

[Fiber Optic Chronology](#)

[Fiber Optics History](#)

[Invention Dimension](#)

[The Tech Museum of Innovation](#)

[How Lightning Works](#)

[Lightning Detection](#)

[Lightning Theme Page](#)



Internet Based Resources: Language Arts

- [Guide to Grammar and Writing](#)
- [Index of Grammar](#)
- [Grammar for ESL Students](#)
- [Kid Info on Grammar and Language Skills](#)



Recommendations to Support Integration

- Develop academic skill competitions within the Career and Technical Student Organizations
 - Create integration activities at the middle school level
 - Create a public relations and marketing campaign aimed at highlighting achievements of those involved in integration
 - Offer incentives for teachers that obtain additional teaching endorsements
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Recommendations

- Articulate academic credit with colleges and universities.
 - Seek student, parent and community input in the process.
 - Utilize existing external standards both academic and vocational sources.
 - Examine the attitudes and stereotypes.
 - Incorporate quality improvement processes.
 - Connect “integration” student senior projects with local problems and issues.
 - Incorporate integration learning activities in teacher preparation.
 - Require future math, English, and science teachers to have practical work experience in their specific field prior to teaching.
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Questions

