

HEAR FROM PROFESSIONALS. LEARN FROM EXPERIENCE.



SCIENCE, TECHNOLOGY, ENGINEERING, & MATHEMATICS

Learners who pursue this cluster will be involved in planning, managing, and providing scientific research and professional and technical services including laboratory testing services, and research and development services.



Learning that works
for Nebraska

WHAT TO EXPECT IN THIS GUIDE



INTERVIEWS

Each video contains interviews with employees and business representatives discussing work requirements, education levels, salary and job prospects.



TOURS

Experience virtual industry tours that provide a unique opportunity to get a glimpse inside Nebraska-based companies without leaving your home or classroom.



INFORMATION

Throughout the videos you will find valuable information regarding job markets, salaries, and educational requirements to help you identify a possible career path.

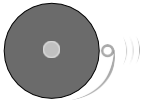
NOTE TO INSTRUCTOR:

These are suggested activities and questions to accompany the virtual industry tour. Each component may be used individually or modified to fit the needs of the classroom. Use these websites for more information on this career cluster:

- www.education.ne.gov/nce/career-clusters
- <https://www.education.ne.gov/nce/careerdevelopment/>
- [Nebraska H3 Reports](#)
- www.nebraskacareerconnections.org

In addition, NEworks has an array of resources, including Nebraska Workforce Trends magazine, Labor Market Regional Reviews, Occupational Profiles, and Career Ladder Posters, available at <https://neworks.nebraska.gov> under Labor Market Information>Additional Services>Publications.

BELL RINGER:



Post on writing surface for students to answer as they enter the room. They will respond individually in their notes. Then have students share with a partner or discuss as a class.

Individuals employed in the stem career cluster have a natural curiosity about the world around them. Describe a time you wanted to understand how something worked and what you did to gain that knowledge.

ANTICIPATORY SET:



Guide students to think about the importance of the STEM career cluster through participation in the raft design competition. Supplies needed: large bin or tub full of water, plastic drinking straws (10 per group), foil (roughly 10-inch square per group), pennies (at least 25) and towels for clean up. Divide students into small groups of three or four. Provide each group straws and foil. give these instructions:

“Your group will compete in an engineering competition. you will design, construct, and test a raft. the goal is to create the raft that will hold the most pennies while staying afloat. You have five minutes and may only use the supplied materials. What questions are there?”

INTRODUCTORY QUESTIONS:



Monitor student progress. after five minutes, have students gather around the tub so all students can see the testing. Rafts will be tested individually. Have the first group place their raft in the tub of water. The group will place pennies on the raft one at a time. When the raft sinks below the water surface, the test is over. Record the number of pennies for each group’s on the writing surface. After the completion of the tests, have students return to their seats and congratulate all teams on completing the engineering task. Facilitate a discussion by asking these questions:

**What raft shapes worked the best?
What methods were effective in connecting the straws to the foil?**

After seeing the results, how would you modify your design to make it hold more pennies? STEM careers focus on finding solutions to problems. Today we used the scientific method to learn about buoyancy, the ability of something to float, and surface tension, the way water molecules bond tightly together. We discovered what raft designs work the best. when in the real world might someone study buoyancy and surface tension?

Answers will vary, but might include: commercial diver (Scuba diver), maritime archeologist, underwater welder, boat builder, personal watercraft designer, marine engineer, water ski designer, submarine design engineer and more.

CONTENT:



Show the 16-minute virtual industry tour, which features three businesses to the class: https://bit.ly/NECTE_STEM.

Students may individually view the video online as well. Have students complete the guided notes worksheet as they learn about the career cluster. Introduce the virtual tour by saying:

Today we will watch a video highlighting three different businesses in the science, technology, engineering, and mathematics (STEM) career cluster. Each business will describe their involvement in the industry, as well as the different careers associated with this area.

FOLLOW-UP QUESTIONS:



Ask the following questions to students after they view the virtual industry tour. Questions can be given as journal questions or asked aloud. Questions can also be assigned individually or in groups.

1. How would you define this career cluster?

- Careers in the science, technology, engineering, and Mathematics (STEM) career cluster study the world and apply their learning to practical applications. Professionals in this cluster are involved in planning, managing, and providing scientific research and professional and technical services including laboratory and testing services, and research and development services.

2. What surprised you about this career cluster?

- Answers will vary.

3. What types of careers are included in this career cluster?

- Biologists, biological scientist, chemist, electrical engineer, entomologist, laboratory associate, mathematician, mechanical engineer, operations manager, quality control microbiology analyst, and quality environment and safety manager.
- Other careers not mentioned in the video: aeronautical engineer, architectural engineer, biotechnology engineer, civil engineer, conservation scientist, cost estimator, dietician and nutritionist, drafter, environmental engineer, financial analyst, industrial engineer, lab/research technician, market research analyst, mathematics teacher, medical scientist, quality technician, science teacher, surveyor, and technical writer.
- A few careers mentioned in the virtual tour are not technically part of the STEM career cluster. However, these jobs are an essential part of the industry. They include: accountants, which are included in the Finance career cluster and jobs in information technology (IT), which is a separate career cluster.

Note to instructor: This would be a good time to explain to students that this career cluster can be divided into two career pathways including:

- Engineering & Technology
- Science & Mathematics

Each career pathway has a narrower skill set for the occupations within this career cluster.

4. Where could you go to receive education/training for these careers?

- Engineering & Technology: Applies mathematics, science, and technology concepts to solve problems quantitatively in engineering projects involving design, development, or production in various technologies.
- Engineers and technologists are involved with advancing technology and continually improve and update product designs and optimize the manufacturing process. They are involved in improving or building new roads, bridges, water, pollution control systems and other public facilities.
- Science & Mathematics applies essential mathematics and science content and skills in a real-world context. occupations include those in physical, environmental, and human endeavors.

5. Fifty-six percent of companies plan to hire more interns than the previous year. What advantages exist for a company to hire interns? What benefits exist for a student to complete the internship?

- The benefit for the business is that it is very expensive to hire people for jobs. Companies like the opportunity to “try out” an employee without having to fully hire them. If the intern fits into the culture of the company, they are more likely to hire them.
- To gain maximum benefits, students should secure a meaningful internship in the field of study that they are interested in.
- They should strive to deliver excellent performance, so they are poised for future employment.
- Benefits include work experience to include on resume and for future jobs, gain knowledge and experience, exposure to real tasks of the job to help determine if this is a future career, some internships are paid, potential to earn college credit, opportunity to network with professionals in the career field, gain new skills, and develop confidence.

6. Why does completion of stem courses during school give an individual a jumpstart on landing a future job?

- The Science, Technology, Engineering, & Mathematics career cluster is experiencing job growth. The demand for students with an educational background in STEM will continue to increase.
- STEM courses are challenging. classes emphasize critical thinking and problem solving. Completing challenging courses in high school will better prepare a student for the rigor of post-secondary education.
- In STEM courses, students often work on projects in a team environment, just as we did making the watercrafts at the start of the lesson. The ability to work with a team successfully and communicate effectively are highly desired career readiness skills.

7. Several stem related professions are considered high skill, high wage, and high demand. What does this mean?

- High skill occupations require some form of training and education beyond high school. Wages are at or above the median average wage of all occupations in Nebraska. The number of annual openings, the net change of employment and the growth rate of the occupation determine the high demand rating.

8. Sometimes STEM is referred to as STEAM. what might the “a” represent and why would this component be included?

- Art and design drive innovation and creativity.
- Art and design will help better connect science and technology with innovative thinking.
- Adding art and design encourages individuals to grow academically and go beyond using the “left brain” or “right brain.”

9. Novozymes uses enzymes to make process in our lives better, faster, and more environmentally friendly. What might be some examples?

- Answers will vary. see <https://www.novozymes.com/en/powerful-biotech/what-are-enzymes> for more information. Here are a few examples:
- Using enzymes to break down the lactose in milk so that more consumers can enjoy dairy products.
- Using enzymes to create the worn and washed look in denim without the use of harmful chemicals.
- Using enzymes to eliminate odors. Fast neutralization occurs, but then odor-causing molecules are captured and degraded.

10. Core academic skills include reading, written communication, listening, speaking and mathematical reasoning with problem solving. How might these core academic skills be used in this career cluster?

- Answers will vary. Here are a few examples:
 - Successful financial analysts will keep current by reading newspapers for current news and market trends. They will read books published by successful individuals in order to hone his or her financial knowledge.
 - Communication is important for any professional. For example, a biologist might write science articles for a scholarly journal, magazine, newspaper, or other publication. Biologists might assemble educational displays, create education videos, or present programs to the public.
 - A civil engineer uses basic arithmetic to calculate water flow over a basin and algebra or geometry to calculate an acceptable roadway curve.

**11. A career ready individual demonstrates perseverance or “grit.”
When have you demonstrated this career readiness skill?**

- Answers will vary.
- Explain to students this is a sample of a question that would be asked during a behavioral interview. Employers use past experiences as a way to predict future performance. Help students prepare for interviews by practicing responses where they use the STAR response: situation, task, action, and result. Example sources for more information, include: https://bit.ly/STAR_technique1 and https://bit.ly/STAR_technique2.

12. The virtual industry tour mentioned traits employers seek when hiring. What career readiness skills should a desirable applicant possess?

- Answers will vary.
- For more information, have students visit: <https://www.education.ne.gov/nce/careerreadinessstandards/>

**EXTENDED
LEARNING
ACTIVITIES:**



The following are suggested activities that will increase student learning and exposure to this career cluster.

- Join a local engineering, robotics, math, or science club. Participate in student competitions in these academic areas.
- Participate in the ACE Mentor program for architecture, construction, and engineering. Visit <https://www.acementor.org/> for more information.
- Select a career from this career cluster. Research the career and present information to the class in the form of an oral presentation, poster, PowerPoint, iMovie, or Prezi presentation. Information to find includes: salary, education required, typical day schedule, positive aspects of the job and negative aspects of the job.
- Make a list of the career readiness skills that are personal strengths. Then make a list of the skills and behaviors required for a career in science, technology, engineering, and mathematics (STEM). Compare the list to determine what career readiness skills need to be strengthened for employment in this career cluster.
- Complete a mock job application and job interview with a local science, technology, engineering, and mathematics (STEM) employer.
- Construct a resume for a specific career in this career cluster.
- Meet with the school counselor to discuss classes that would help prepare a student for careers in this career cluster. Also, discuss certifications that can be obtained during high school.
- Identify a post-secondary institution that is offering certifications or degrees that are required in this career cluster. Obtain and complete admissions and scholarship applications for the school or program.

THERE ARE MANY RESOURCES THAT CAN BE USED BY TEACHERS, PARENTS AND JOB SEEKERS FOR CAREER EXPLORATION.

Some resources are tailored for Nebraska and some are national, but all provide valuable information and many incorporate information from the Nebraska Department of Labor Market Information (LMI). This list is not comprehensive, and only represents a sampling of the many resources available. Share the Career Exploration/ Planning resources table with students and have them do a review of what each offers them as a tool for finding the right career fit. Nebraska Career Connections is a totally FREE resource that is highly recommended for use by career and technical education students and teachers.

CAREER EXPLORATION & PLANNING		
Website	Type of Resources Available	Produced & Sponsored By
Nebraska Career Connections www.nebraskacareerconnections.org	Education and career planning resources for students, parents, educators, adults and employers. Students can explore career options, search for colleges, find out about applying for college, tuition, scholarships & financial aid, and create an e-portfolio and resume.	Nebraska Departments of Education and Labor, Nebraska VR, and Partnerships for Innovation.
Nebraska H3 Reports: https://bit.ly/neH3	Information on High Wage, High Demand, High Skill jobs in Nebraska. Top H3 occupations are identified on the home page. Reports can be generated by each Nebraska Economic Development Region and also statewide. Reports include H3 Report, Nebraska Economic Industry Report and All Career Clusters Report, Jobs can be searched by Job Title or SOC Code.	Nebraska Departments of Education, Labor and Economic Development
O*NET OnLine www.onetonline.org	Occupation information: knowledge, skills, abilities, Career Interest profile, job outlook and wages	U.S. Department of Labor, Employment and Training Administration (sponsor) Developed by the National Center for O*NET Development
My Next Move www.mynextmove.org/	Condensed version of information from O*NET OnLine	
Occupational Outlook Handbook www.bls.gov/ooh/	Nationwide data on occupation pay, work environment, job outlook, similar occupations, and more	Bureau of Labor Statistics
Nebraska Reality Check https://www.education.ne.gov/nce/career-readiness-videos/	Lifestyle cost information and occupations in corresponding wage range	Nebraska Department of Education

IN-DEPTH		
Website	Type of Resources Available	Produced & Sponsored By
CareerOneStop www.careeronestop.org	Variety of resources related to career planning, job training, and job searches	U.S. Department of Labor, Employment and Training Administration (sponsor)
GetMyFuture (section of the CareerOneStop website) www.careeronestop.org/GetMyFuture	IResources tailored to students and young adults such as career exploration, information on finding education and training programs, and how to conduct a successful job search.	U.S. Department of Labor, Employment and Training Administration (sponsor)

Instructions: Question 1 should be answered by watching all three sections of the virtual industry tour.

1. List eight careers mentioned in the virtual industry tour.

- | | |
|--------------------------------|--|
| 1. Biologist | 5. Entomologist |
| 2. Biological scientist | 6. Mathematician |
| 3. Chemist | 7. Mechanical engineer |
| 4. Electrical Engineer | 8. Quality Control Microbiology Analyst |

Laboratory Associate, Operations Manager, and Quality Environment and Safety Manager

2. Where is each business located?

Business	Location
Nova-Tech	Grand Island, NE
Novozymes	Blair, NE
LI-COR	Lincoln, NE

Instructions: the following questions are specific to the nova-tech section.

3. Describe what Nova-Tech does:

Keeps the public healthy by focusing on pharmaceuticals for animals on the farm. they create products used to treat sick animals with fluid replacement therapies or IVs.

4. In Nebraska, on average, how much per hour are chemists paid? **\$33.35**

5. How many STEM related educational programs are offered in Nebraska colleges?
Over 450

6. Describe a sterility test:

This test checks for microorganisms in finished drug products. The samples are incubated for 14 days, then the sample is checked to make sure the test is negative. The sample must be 100% pure to ensure a safe, acceptable product.

7. In 2022, what percent of chemists were employed in the manufacturing industry?

62%

Instructions: the following questions are specific to the Novozymes section:

8. Describe what Novozymes does:

Novozymes creates environmentally friendly solutions to processes in industry. Enzymes are used in products to make our lives better, faster, and more eco-friendly.

9. What is an enzyme?

An enzyme is a biological structure with a specific metabolic activity. For example, enzymes in the stomach help to digest food to help absorb the nutrition.

10. What percent of biological scientists are female? **53.9%**

11. Describe the job responsibilities of a quality control microbiology analyst:

He or she will test products to detect contamination or bad bacteria in products in order to ensure a good product.

12. Describe the steps to creating a slide to test for contamination in samples:

Using a dropper, place one drop of water on a clean glass slide. Use a one micro-liter loop and dip in the sample. Place some of the sample on the slide. Place a small glass slide on top. View the sample using a microscope. A sample that is contaminated will look like dancing rods. If contamination is found, then the sample will be sent off for further testing and identification.

Instructions: the following questions are specific to the LI-COR section.

13. Describe what LI-COR does:

Develops instrumentation for global climate change research, drug discovery and disease research. This helps to cure diseases, improve help, and grow crops.

14. In Nebraska, on average, how much per hour are soil and plant scientists paid? **\$29.30**

15. Besides Nebraska, where else does LI-COR have facilities?

They have a research facility in California and an office in Germany.

16. Describe the job responsibilities of an applications analyst:

This person provides tech support for customers via phone, e-mail, and website chat. They answer questions about broken instruments, troubleshoot problems, setup, measurement, and use.

17. Describe the function of a portable photosynthesis system:

This machine analyzes and measures the gas exchange in a leaf. It is easily placed on a leaf plant and readings can be obtained immediately, if needed. The charts show photosynthesis over time and conductance through the stomates of the leaf. To use the machine, clamp the chamber on to the leaf. This measures how much co2 is going into the plant for photosynthesis and how much co2 the plant is releasing.

Instructions: Respond to Question 16 after watching all three sections of the virtual industry tour.

18. Which of the careers introduced in the virtual industry tour best fit your skill set and interests? Explain?

Answers will vary.



ABOUT THIS PROJECT

The virtual industry tours provide a unique opportunity for students, parents and job-seekers to experience Nebraska-based industries without leaving the home or classroom.

The videos showcase different businesses and industries in each of the sixteen Career Clusters plus Entrepreneurship in the Nebraska Career Education Model. In addition to the tour of the business or industry, the videos also contain interviews with employees and managers discussing work requirements, education levels, salary and job prospects. The videos provide an accurate picture of today's workplace, breaking down stereotypes and assumptions while emphasizing the knowledge and skills required to be successful.

The teacher and student guides are designed to enhance student learning for each virtual tour. For the students, a guided notes worksheet is included to help them record important information about the career cluster. The teacher's guide includes a lesson plan complete with anticipatory set, introductory questions, and discussion questions to follow the virtual tours.

Discussion Guides and Career Readiness Resources are available at:
WWW.NEBRASKACAREERCLUSTERS.COM/RESOURCES



It is the policy of the Nebraska Department of Education not to discriminate on the basis of sex, disability, race, color, religion, marital status, age, national origin, or genetic information in its educational programs, admission policies, employment, or other agency programs.

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