Evaluating Science, Mechanics and Engineering Exhibits

The Science, Mechanics and Engineering Department includes a grouping of several different project/program areas. Although each is unique in what youth can learn and do they are similar in that these projects and programs focus on science technology and their application.

Project/Program Objectives

Science, mechanics and engineering projects and programs help 4-H'ers to:

1. Develop life skills, particularly in decision making, learning how to learn, communication, leadership and citizenship.
2. Learn scientific principles associated with the various subject matter areas.
3. Develop a spirit of inquiry about science and technology.
4. Develop skills in using tools and equipment associated with these projects and programs.
5. Learn care and maintenance of equipment.
6. Learn and practice safety procedures to prevent personal injury and property damage.
7. Be able to figure costs associated with constructing, rebuilding and restoring science, mechanics and engineering projects.
8. Consider planning and conducting community service activities related to these project program areas.
9. Explore career and vocational opportunities associated with science and technology.

Current Emphasis, Trends, Changes

1. Life skills are being incorporated into the technical knowledge and skills learned through involvement in these project and program areas.
2. Science and technology is rapidly expanding and increasing in our society. This is especially reflected in the project areas of computers and electronics.
3. Restoration of old equipment and machines continues to be popular even though project material provided through the 4-H program does not address the processes. Classes most likely to include restoration are automotive, tractor and small engines. Bicycle and electric exhibits may also be restorations.
4. The "IDEA" (B) classes will include a variety of exhibits other than the actual products formerly associated with science and engineering classes. This will include educational displays or other types of exhibits which show some idea or process involving these projects. Expect creativity!

Special Evaluation Considerations

1. Safety is particularly important in mechanical exhibits. It is important that safety problems are called to the attention of the exhibitors even though they may not directly relate to their goals. Examples are: shields on belts and power-take-off shafts, proper grounding of electrical wiring, strength of welds in critical places, non-leaking exhaust systems on cars, etc.
2. Restored articles such as tractors, cars, engines, etc. should be restored as authentically as possible, if restoration is the goal of the member. Examples include original color paint, accessories, parts (if available), etc. Note, however, that the

goal may be to rebuild an old items to make it usable, not as an authentic restoration.

3. Some larger or more complicated exhibits may be done in stages. For example, as a part of an auto restoration, a car engine may be restored or rebuilt one year and the car body another year. The exhibit should be evaluated on the goal and accomplishments for the given year.

Suggested Conference Evaluation Questions

Conference judging should be based on the goals the 4-H'ers have for their exhibits. All exhibitors should be expected to respond to these four questions:

1. What was your goal(s)?
2. How did you go about working toward your goal(s)?
3. What were the most important things you learned as you worked toward your goal(s)?
4. What ideas or plans do you have for the future based on what you have learned or discovered?

As a judge, you will want to ask additional questions that relate directly to the exhibit or the project/program from which it came. The responses to the initial questions will give you leads for follow-up questions. Listed below are some examples of follow-up questions that will help the 4-H'ers explain what they have done and learned. Select the questions that will get you the kind of information you want.

WHAT questions most often lead to facts.

1. What gauge wire did you use for the electrical outlets?
2. What type and size of electrodes did you use in welding this item?
3. What tools did you use in making this bookcase? Which of these were tools you had not used before?
4. What do you want people to learn by looking at your display?
5. What other applications have you made with your computer?
6. What safety precautions did you have to take when making this item?
7. What science information did you learn?

WHERE questions most often lead to location or source of information.

1. Where did you get the plans for your picnic table?
2. Where did you find this old engine that you restored?
3. Where would you go to get more information on model rockets?
4. Where could I go to find out how to make my home more energy efficient?

HOW questions often lead to a discussion about processes, sequences or feelings.

1. How did you get such a smooth finish on this table?
2. How else could you have connected these two wires together?
3. How did you get a badly rusted car to look so good?
4. How do you feel about being able to keep your 4-H records on computer?
5. How could safety be emphasized more in your exhibit?
6. How can you use the new information you learned?

WHY questions often lead to a discussion of reasons.

1. Why did you select a science and technology project?
2. Why did you select this type of wood?
3. Why did you make this display?

4. Why did you restore this old tractor instead of purchasing a newer one?
5. Why is it important for young children to learn and practice safety when riding their bicycles?
6. Why is it important to learn about science?

COULD questions may result in a variety of answers and can be used to take the command out of *tell me* or *give me* statements.

1. Could you tell me more about the reasons you used different kinds of welds?
2. Could you tell me why you are so interested in computers?
3. Could you have used a varnish finish instead of paint on this toy box?
4. Could you give me some examples of other illustrations you have designed with your computer?
5. Could you tell me why you enjoy repairing engines?
6. Could you tell me how you might change your experiment if you could do it again?

Resource Material

The following are available from each county Extension office or can be ordered online at https://www.extension.iastate.edu/store/. Those with PDF are available to download and print.

Aerospace

4H 81, Rockets Away! A Fun Approach to Exploring the Science of Rocketry
4H 81 LDR, Rockets Away! Teachers Edition
4H 82A Stage 1: Pre-Flight—Aerospace Workforce Skills for Life Series
4H 82B, Lift-Off Stage 2—Aerospace Adventures Activity Guide
4H 82C, Reaching New Heights Stage 3—Aerospace Adventures Activity Guide
4H 82D, Pilot in Command Stage 4—Aerospace Workforce Skills for Life Series
4H 82 LDR, Flight Crew, Aerospace Group Activity Guide
4h 87, Toys in Space Level 1—E-SET, Helper/Educator Guide and Youth Activities Set (pink folder)
4H 87A, Liftoff to Learning: Toys in Space II, video
4h 88, Toys in Space Level 2—E-SET, Helper/Educator Guide and Youth Activities Set (blue folder)

Welding

4H 417, Arcs and Sparks—Shielded Metal Arc Welding

Automotive

4H 232, Exploring 4-H Automobile Restoration Opportunities Resource Sheet

Bicycle

4H 689A, Bicycling for Fun, Bicycle 1, Fun Activities for Youth Cyclists
4H 689B, Bicycle Adventures—Level 2
4H 689C, Bicycle Adventures—Level 3
4H 689 LDR, Bicycle Adventures, Helper's Guide

Electric and Electronics

4H 410A, Magic of Electricity, Level 1, Grades 4-6
4H 410B, Investigating Electricity, Level 2, Grades 7-8
Wired for Power, Level 3, Grades 9-10
4H 410D, Entering Electronics, Level 4, Grades 11-12

4H 410 LDR, Electric Group Activity Guide, Helper's Guide

Science and Technology

4H 952, Funtivities: Hands-On Science and Math, Level 1, Grades 4-5
4H 952 LDR, Funtivities Leader Guide, Level 1, Grades 4-5
4H 952 TR, Funtivities Guide and Video
4H 953, Funtivities, Level 2, Grades 6-8
4H 953 LDR, Funtivities, Leader Guide, Level 2, Grades 6-8
NCR 483, Careers in Biotechnology, PDF,
http://www.extension.iastate.edu/Publications/NCR483.pdf
NCR 487, Principles in Biotechnology, PDF,
http://www.extension.iastate.edu/Publications/NCR487.pdf

Small Engines

4H 715A, Crank It Up! Small Engines Level 1
4H 715B, Warm It Up! Small Engines Level 2
4H 715C, Tune It Up! Small Engines Level 3
4H 715 LDR, Helpers Guide, Small Engines

Tractor

4H 732, 4-H Tractor Operation and Safety Manual
4H 733, Exploring 4-H Tractor Restoration Opportunities
PM 646M, Safe Operation of Agricultural Equipment—Student Manual
PM 646 LDR, Safe Operation of Agricultural Equipment—Instructor's Manual

Woodworking

4H 745A, Measuring Up, Woodworking Wonders Level 1
4H 745B, Making the Cut, Woodworking Wonder: Level 2
4H 745C, Nailing It Together, Woodworking Level 3, Grades 7-8
4H 745D, Finishing Up, Woodworking Level 4, Grades 9-12
4H 745 LDR, Woodworking Helper's/Leader's Guide

Member and Leader Project Information List

Video

Judging 4-H Engineering Exhibits, (#75492)

- Part I - Why Do It?
- Part 2 - Evaluating An Exhibit
- Part 3 - Conference Judging
- Part 4 - Criteria and Standards

Available in area Extension offices and in film/video library at Iowa State University. (See *Video No. 75492: Judging 4-H Engineering Exhibits*, VI-1076-RH (1992), for an explanation of the use of this video for judging based on goal centered learning.)

Judging Philosophy Resources

Strengthening Goal-Centered Learning in the Exhibit Experience (4H-203)
Video - Talk About My Goals…Goal-Centered Learning (#75745) available from county Extension Office and in film/video library at Iowa State University.