

CAMP INVENTION INSTRUCTOR GUIDE

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Camp Invention®

FOREWORD

Introduced in 1990, National Inventors Hall of Fame® programs have encouraged students to explore their creativity and innovation through Science, Technology, Engineering, and Mathematics (STEM) activities and real-world challenges, fostering a lifelong interest in inventive thinking.

Created by the National Inventors Hall of Fame®, Camp Invention® was inspired by the Inductees, who are integrated throughout the curricula. In collaboration with the United States Patent and Trademark Office, Camp Invention® gives children the opportunity to take risks, use creative problem solving, and develop an entrepreneurial mindset.

To date, the National Inventors Hall of Fame® has impacted over two million children, teachers, parents, college students, and inventors through education and recognition programs, including Invention Playground®, Camp Invention®, Club Invention®, STEM Maker Lab®, Invention Project®, and the Collegiate Inventors Competition®.

Please visit the Camp Invention® website at invent.org/camp to learn more. The National Inventors Hall of Fame® makes no warranty, explicit or implied, as to the safety or suitability of our activities. We urge you to always use proper safety equipment and precautions.



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Inspiring future innovators®

CAMP INVENTION® INSTRUCTOR GUIDE

The Camp Invention Instructor Guide is designed to support the successful delivery of the Camp Invention program. The guide is formatted similarly to a Camp Invention module. Included are design goals with suggested implementation strategies that reflect participant and educator feedback received through pilots, evaluations, and onsite observations. Each section gives the Instructor strategies for implementing the various components. While these strategies are not all-inclusive, we find that they tend to hold true across all Camp Invention curricula.

OVERVIEW

The Overview section of each module explains the focus of the curriculum sessions. It provides the Instructor with goals and curriculum content, along with a checklist of the day's activities. The Instructor's role throughout the sessions is to act as a facilitator or guide. Instructors should not feel as though they must have all the answers; stimulating a sense of exploration in children is one of the primary goals of the curriculum. Exploration is best modeled by an Instructor who empowers children to pursue answers to and insights on their curiosities.

This module provides participants entering kindergarten through sixth grade with the opportunity to apply classroom learning in an informal, problem-solving context. While the curricula are science-based and align with national education standards, all are written in a transdisciplinary approach that includes other subject areas such as technology, engineering, mathematics, social studies, literacy, history, the arts, and the 21st century skills of creative and critical thinking, problem solving, collaboration, and communication.

KEY CONCEPTS

The Key Concepts guiding the design of the Camp Invention program are that participants learn by:

- Being creative.
- Solving problems.

- Building on prior knowledge and experiences.
- Participating in authentic learning.
- Having fun.

OBJECTIVES

The **Objectives** of the Camp Invention program are:

- Encourage risk-taking and the search for solutions.

- Provide exploration within an open and safe environment.
- Create an immersive, hands-on learning experience.

PLAN AHEAD

Read each day's Plan Ahead section at least 24 hours before the start of that day's session.

Familiarize yourself with the material.

SETTING THE STAGE

The Setting the Stage section provides information on how to create the immersion for the module. The most important part of Setting the Stage is creating a risk-free, inviting, and relaxed environment. One way that Instructors

can accomplish this setting is to move desks and chairs out of the way, giving participants space to work and build. For additional ideas about setting up the space, see Key Component One: Immersion.

INVENTOR SUPPLY ROOM

The Inventor Supply Room is the space designated for storing the recyclable and upcyclable items (e.g., empty milk jugs, fabric, old toys, cardboard, containers, etc.) brought in by the program participants. Some of the activities within each module make use of these materials for designs and inventions. Use any material that is safe and might otherwise be discarded. Using Inventor Supply Room items reinforces to children that expensive lab equipment is not always necessary to conduct science. As materials become more scarce

throughout the program, the following can be done:

- Ask the Director to request more recyclables from the parents (this can be communicated via the newsletter, a note home, or a visible sign in the pick-up area).
- Limit the number of recyclables children can use for an invention or project.
- Limit the size of the invention or project (e.g., must fit on a desk).

PROPER LIFTING TECHNIQUES

It is important to keep in mind safe and Proper Lifting Techniques when moving a heavy load. Always check the load to see if lifting it is manageable or if you should ask for assistance. If you are able to safely lift the load, check to make sure you have a clear walking path, always bend at your knees while lifting with

your leg muscles, and keep your back straight. Slowly lift up while keeping the load close to the body and holding it with a tight grip. Do not twist your body as you lift the load. Carefully walk the load to the desired location, lower using your leg muscles, set it straight down, and push into place, if necessary.

NOTE CALLOUTS

This curriculum is designed to provide thorough, detailed instruction while maintaining a simple, reader-friendly structure. Several Note Callouts have been incorporated throughout the curriculum. They are intended to highlight important information, provide

easy-to-find reminders, and point out opportunities for differentiation.



INSTRUCTOR BACKGROUND

Instructor Background information is provided as a resource for understanding the concepts presented in the curriculum. This information is meant for you, the Instructor, and is not intended to be read out loud word for word to the children. However, as discussion is

conducted, information from this section may be shared. Additional sources of information on the concepts covered are available in the References and Resources Section at the end of the module.

NATIONAL INVENTORS HALL OF FAME

Camp Invention programs feature National Inventors Hall of Fame Inductees in a variety of ways to introduce children to the people behind the inventions. The National Inventors Hall of Fame was established in 1973 to honor the individuals who conceived, patented, and advanced the great technological achievements developed since the birth of this nation. The National Inventors Hall of Fame is located in Alexandria, Virginia, on the campus of the United States Patent and Trademark Office (USPTO), a founding partner of the National Inventors Hall of Fame.

The National Inventors Hall of Fame maintains an annual tradition of selecting Inductees through a process that accepts nominations

from all sources and relies on a panel of experts in the fields of science, technology, engineering, and patents to screen, vet, and make final selections.

The criteria for induction into the National Inventors Hall of Fame requires candidates to hold a U.S. patent that has contributed significantly to the nation's welfare and the advancement of science and useful arts. In addition, the National Inventors Hall of Fame may choose to present the Lifetime Achievement Award to honor individuals who have made significant contributions to invention and the American system of intellectual property protection.

INTELLECTUAL PROPERTY LITERACY™

Camp Invention partners with the USPTO, integrating an understanding of Intellectual Property into many activities.

What Is A Patent?

A patent protects an invention. A patent is an intellectual property right issued to an inventor by the U.S. government. It excludes others from making, using, offering for sale, selling, or importing the invention throughout the United States for a limited time in exchange for public disclosure of the invention when the patent is granted. By publicly disclosing an invention, others may learn from it. After a patent expires, the invention enters the public domain and may be used by anyone. Patents are only valid in the country in which they have been issued.

What Is A Trademark?

A trademark is a source identifier. It explains a product's or service's source and origination. A trademark can be almost anything, including a word, phrase, symbol, design, or combination of those, identifying the source of a product or service (known as a service mark) and distinguishing it from other sources of similar products or services. In some cases, even color, sound, scent, or product shape can function as a trademark if it is capable of identifying and distinguishing the source of goods and services. If a trademark or service mark is not registered with the USPTO, the symbol ™ or SM is used, and if the product or service is registered, then the symbol ® is used.

For more information on patents and trademarks, visit the USPTO website at uspto.gov.

KEY COMPONENTS

All Camp Invention curricula contain the following Key Components:

1. Immersion
2. Create, Test, and Recreate
3. Science, Technology, Engineering, and Mathematics (STEM)

4. 21st Century Skills including:
 - Creativity and Innovation
 - Creative Problem Solving
 - Team Building and Collaboration

KEY COMPONENT ONE: IMMERSION

Instructors create a sense of immersion as they facilitate challenges within a story-based and problem-solving context. Using language that allows participants to “buy into” the storyline encourages them to embark on a dynamic STEM and creativity adventure.

Within each Camp Invention module, the Setting the Stage section gives suggestions for implementing immersion. These suggestions can expand, depending upon an Instructor’s imagination and access to materials. Setting the Stage ideas are intended to serve as a guide and not limit immersion. We suggest

adding props and using provided or borrowed materials to transform the classroom into another place or time.

Methods for incorporating immersion in a module include:

- Changing the physical environment of the classroom to reflect the scenario of the module.
- Assuming a character role while interacting with participants.
- Sharing information that will make a scenario realistic to participants.

KEY COMPONENT TWO: CREATE, TEST, AND RECREATE

Camp Invention curricula use the Create, Test, and Recreate approach to learning by using scientific inquiry and engineering design. After clarifying the challenge or problem, participants begin exploring and investigating. Children build models, prototypes, and inventions. Encourage them to reflect on the strengths, weaknesses, opportunities, and interesting aspects of their creations and then refine their inventions. This approach allows participants to build skills in self-assessment, adaptive creativity, and evaluative thinking. Participants also increase their tolerance for and learn the value of trial and error, especially as it pertains to idea and/or product development and evolution.

The Create, Test, and Recreate learning approach challenges children to use materials to build solution prototypes, test and evaluate their solutions, and modify their designs, and then repeat the process. The focus of the Create, Test, and Recreate learning approach should be on the process of creating, not on the product being created.

Participants work both individually and in groups to create their solutions from provided materials. They must think through how their designs will work and what materials they should use before they begin building.

During the Create, Test, and Recreate learning approach, all group members must be involved. Some members may choose to take on individualized roles, but all should have a say in the process.

Once created, participants should test their designs. Sometimes, a solution works as planned, while at other times, it does not. If a design does fail, it should not be treated as an end, but rather as a chance to try new solutions. New inventions often come out of those that do not work. Nevertheless, a failed design may be very frustrating for some participants. Encouragement and coaching is needed to inspire these participants to continue working toward a solution. Using open-ended question such as, “How could you...?” can provide focus and generate new solution ideas.

KEY COMPONENT THREE: SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS (STEM)

STEM subject areas come to life for participants through fun problem-solving challenges. Camp Invention curricula view STEM content as a vehicle for the direct application of creativity and innovation skills. Camp Invention curricula are written using a transdisciplinary approach that goes beyond STEM and includes

additional subject areas and 21st century STEM-focused skills that create engaging, meaningful challenges. Many of the critical challenges facing today's generation of participants will require STEM knowledge, keen creative problem solving, and collaboration skills.

KEY COMPONENT FOUR: 21ST CENTURY SKILLS

Creativity and Innovation

The skills of creativity and innovation, creative problem solving, communication, and collaboration have been identified as key 21st century skills. The Camp Invention program employs a wide variety of tools, techniques, and processes to foster these skills.

Divergent Thinking

Divergent thinking is the act of generating ideas. Brainstorming is one key tool that is used to help in this process. By following the Rules of Brainstorming (located in the back of the Inventor Logs), individuals can keep an open mind to identify as many novel ideas to a challenge as possible:

- Accept all ideas. (Do not allow anyone to criticize another's ideas.)
- Think of as many ideas as possible. (The more ideas generated, the more opportunities to build new ideas.)
- Build on another's idea. (Piggybacking ideas leads to more innovative solutions.)
- Use wild and crazy ideas. (The more outrageous the idea, the more ideas are likely to flow from it.)
- Keep looking for new ideas. (Do not quit thinking too soon.)

The following are step-by-step instructions for facilitating brainstorming during a Camp Invention module:

1. Have participants sit on the floor facing the board (or chart paper).
2. Explain to participants that they will brainstorm a particular problem.

3. Explain that there are rules to follow when brainstorming, and review the Rules of Brainstorming in the back of the Inventor Log.
4. Inform participants of the situation or problem that they will brainstorm.
5. Explain to participants that it is not necessary to raise their hands.
6. Before brainstorming, look at the clock and take note of the time. Brainstorm for no more than 5 minutes.
7. Elicit responses from participants.
8. Write participant responses on the board or on a sheet of chart paper.
9. Use open-ended questions to enhance brainstorming, such as, "How could another material be used?" or "What else could be done?"
10. Encourage total participation.

Convergent Thinking

Convergent Thinking phase is the act of narrowing down and selecting one or more ideas. Participants look for ideas that stand out, shine, and have the most potential. When it is time for participants to converge on their ideas, explain that they will have to let go of some of the ideas that they generated. This does not mean that the discarded ideas are not good or useful, it is just that another idea(s) is a better compromise for the team.

During divergent and convergent thinking, the Instructor acts as the process facilitator, making sure that all participants have the opportunity to have their voice heard.

The following are step-by-step instructions for applying convergent thinking in a Camp Invention module:

1. After brainstorming, have participants meet as a group or in small groups. In some modules, participants may even work individually. (Refer to the module on how to group participants.)
2. Have participants look at the list of ideas generated during brainstorming.
3. Tell children that there are rules to follow for idea selection, or convergent thinking, just as there were with Brainstorming. They are to be positive (look at the ideas in their best light), check your goals, look for originality, and go with your gut.
4. Have participants choose an idea to work on.

Creative Problem Solving

Several of the Camp Invention modules employ the spirit of the Creative Problem Solving process (CPS). CPS is a dynamic balance of divergent thinking (generating ideas) and convergent thinking (selecting ideas) as a person or group assesses and explores a challenge that needs to be met through the implementation of novel ideas.

By utilizing CPS during the invention process, participants assess challenges, collect data by testing, generate solutions through trial and error, and continuously refine their ideas and inventions as they evaluate and reflect. In addition, when participants use the CPS process by engaging in hands-on challenges, they are more likely to internalize the process and use it when they encounter new challenges.

Team Building and Collaboration

The opportunity to work with others in a team is present in all Camp Invention curricula. Learning how to work in teams, both locally and virtually, and collaborate on projects are skills that today's participants need to meet tomorrow's successes. In learning to work as a team, participants build tolerance, respect, and enthusiasm for diversity (including differences in creative-thinking and problem-solving

styles) and can move from individual ideas to a common solution that expresses a group's collective creativity and intelligence.

Simply placing participants in groups is only one small piece of giving them a team-oriented experience. It is through careful observation, coaching, reflection, feedback, and engaging in numerous opportunities for adaptation that participants actually build the skills necessary to be effective team members in the 21st century. As the facilitator of this process, you help participants develop these skills. Methods to support team building and collaboration are module-specific; however, all Camp Invention modules contain the following support strategies for helping Instructors more smoothly facilitate this process.

Tips for Teams

Throughout Camp Invention modules, many activities take place in teams. Sometimes, teams and participants encounter conflicts, which should serve as learning and growth experiences. Do not solve all of the conflicts for participants; allow them to resolve their own conflicts, but do support the process. Encourage participants to peacefully approach conflict and solve problems on their own. Use the Team Rules located in the back of the Inventor Logs during activities to help participants think critically about how they can resolve conflicts productively, listen, and reflect on everyone's ideas, have a good attitude, remain open, work toward common goals, and be aware of others' individual styles.

Provide an object (e.g., a pencil, foam block, or rolled-up piece of paper) for each team member to use as a talking stick when they want their voice to be heard. When a teammate holds up the object, that person is the only one who can talk. The rest of the team must listen. When the teammate finishes speaking, they then pass the object to another team member. While teams do not always need to use their designated objects while working, this technique can be helpful when groups of participants are not listening to one another. Therefore, tell teams to only use their designated objects when necessary.

Explain to participants that part of their challenge is to work well as a team. Sometimes, this is very easy; other times, it is difficult. Tell participants that there are rules when working in teams. Discuss with participants the Team Rules and ideas to help when they are stuck.

Team Rules

- Agree on the same goal.
- Have a good attitude toward others and their ideas.
- Be patient with yourself and your team.
- Include everyone.
- Have fun!

Remember, it is not always about who has the best idea; rather, it is about how to put together everyone's ideas to create a new idea that would not have been possible without working together!

When You Are Stuck

- Ask your team, "What have we not tried?"
- Work backward.
- Look for a pattern.
- Consider extra help from another team.
- Take risks.

ACTIVITIES

Each Camp Invention session is comprised of two or more separate Activities that can be facilitated using the Step-By-Step Instructions. Oftentimes, the opening activity or activities are designed to present or reinforce knowledge necessary to dive into the challenges that follow. For example, participants experiment with Newton's Three Laws of Motion before inventing safety devices for an automobile. When a learning moment presents itself during an activity, Instructors should feel free to allow participants to explore ideas. Adapt the pacing of the activities based upon engagement levels. We believe Instructors must have the

freedom, initiative, and flexibility to provide the highest degree of engagement.

Camp Invention programming emphasizes exploration of STEM by actively "doing" versus passively listening. Activity instructions, which have been rigorously tested in a wide variety of settings with participants in kindergarten through sixth grade, are written in a manner that allows children to make discoveries primarily through hands-on exploration. It is important that the step-by-step instructions are followed in order to create a fun out-of-school time experience and not digress by providing more or different content.

PRIMARY PARTICIPANTS

Young children exercise their creativity freely, in a manner that often inspires more novel thinking in others around them. Keep the following tips in mind when facilitating Primary Participants throughout the program:

Young children need to feel safe and comfortable in their environment. Having information, like where the bathroom is and when and where they will be eating, can be helpful in aiding in their sense of security.

- Primary participants may not be used to having the freedom to choose what they make and create in a classroom-type environment. This is an empowering, but potentially new, experience. Encourage them

to explore a little more each day.

- While all terms and concepts used in the program may not be familiar to Primary participants, and they may not retain some of this information, what is important is that seeds are being planted and positive associations between science, discovery, inventing, and fun are being made.
- Sometimes just having access to fun materials (e.g., printed tape and pulleys) is an exciting starting place for Primary participants. Having a positive experience in this environment encourages them to engage in future STEM activities.

PRIMARY PARTICIPANTS

- Encourage them to sketch their ideas if they are unable to or uncomfortable with writing letters and words in their Inventor Logs.
- As with all participants, focus more on children's ideas and vision versus the functionality of their invention(s).
- Manipulating materials is often an important aspect of being a successful inventor. The experience of experimenting with materials (e.g., cutting recyclables and using tape effectively), in order to bring their ideas into physical form, is a main goal for the Primary participants.

LEADERS

Your Camp Invention site may have Leaders-in-Training and/or Leadership Interns available to help support the program. There are many opportunities for Leaders to contribute to the program. Look for the term "Leader" in the curriculum and maximize these opportunities

to streamline planning ahead, facilitating activities, and empowering the Leaders at your site. Reference the Leader Guide for more detailed, day-by-day suggestions for each module.

INCLUSION

The Camp Invention program strives to make all experiences **inclusive** and accessible to all children regardless of ability. There are many measures that can be taken to help ensure inclusivity. If any children are having trouble engaging with the program, consider ways that the environment, process, and/or activity might be adapted to give them access. There are a wide variety of ways to provide accommodations, and as professionals, we know that you will identify the best methods to do so. This is not an exhaustive list of accommodations. Strive to include all children in a way that is meaningful.

The Environment

Be mindful of the physical setup of the space and the experience it offers for the children present. Rearrange the materials and workspaces to be as inclusive as possible.

While music can enhance the building experience, some children may benefit from it being turned down or off.

Create an Inventor's Corner as a break area for children that may need time and/or space away from the activity or group (e.g., a reading nook or quiet space). In this area, place clay, putty, recyclables, masking tape, or other available materials that may be manipulated.

The Process

Clearly, descriptively, and efficiently describe the information presented on posters and other visual aids. Utilize handouts to support children's learning. Some children may require handouts and posters to be reviewed again one-on-one. Utilize Leadership Interns to assist with reading and reviewing, as needed.

Replay videos with narratives as needed and as is supportive; this can be for individuals or groups.

Be flexible on allowing children to work on their own, with a partner, or in teams per their capacity.

Allow children to take breaks from the group, as needed. Encourage them to use a calming break area, such as the Inventor's Corner.

Use the Inventor Log as a supportive resource, adapting its function based on need. Sketching in the Inventor Log may give a child a meaningful time away from the group and/or activities. It can also be used for self-expression, a focus on details, and/or serve other purposes that may enhance the child's experience. If a child has trouble (or is frustrated with) writing or does not want to draw, they may skip this step and go straight to building.

INCLUSION

Encourage children to view “failure” in a positive light. Explain that the National Inventors Hall of Fame Inductees speak about how failure during their invention process was helpful and essential. Emphasize that even famous inventors have ideas and prototypes that do not work and experience many failures before they have a successful design.

Tap into the empathy, support, and leadership skills of Leaders-In-Training and Leadership Interns to support individual children’s needs. Consider assigning a Leadership Intern to support any neurodiverse children. Be mindful that the opportunity for children to be included in a community invention experience is just as significant as what each child is making and creating.

The Activities

Focus on the quality of the process and experience versus the end product. For example, perhaps the process of using tape

to put recyclables together is providing ample engagement and challenge. Also permit them to build their own invention ideas instead of the challenge given in the curriculum.

The recess-style nature of the Camp Invention Games module may overstimulate some children. Consider having alternative, less noisy, independent activities such as building with a pile of recyclables or manipulating clay off to the side.

Many invention-based activities require tape. Consider preripping tape strips and making a tape strip wall or table for children that may need extra assistance.

Working collaboratively in a team can be a challenging experience for all children. Monitor groups for any inappropriate interactions such as bullying or teasing, and make appropriate adjustments to correct the behavior. Some children may need to work individually on projects.

TIMING

The length of time module sessions run varies between Camp Invention program hosting sites across the country, providing flexibility to meet sites’ specific needs. Modules typically run anywhere between 50 and 75 minutes. Use the Timing notes provided in the module as a general gauge for pacing the activities in each session.

Keep the pace moving without rushing children if they are engaged. You may not be able to complete all of the activities in a given session. It is not advised to complete activities on days other than the days suggested. Plan your day based on the estimated times, but be prepared to flex and adapt based on the children’s levels of energy and engagement.

STEP-BY-STEP INSTRUCTIONS

In the Step-By-Step Instructions, you will sometimes see indented sections of text that also include an image of a speech bubble. These sections are meant for the Instructor to use as a script and read out loud. Since these sections are often designed to help create immersion, it is best if the Instructors familiarize themselves with the content in order to share it in as natural a tone as possible.



GUIDING QUESTIONS

Guiding Questions are provided to encourage reflection and learning. Instructors can ask these open-ended questions before, during, and after activities. Guiding Questions almost always call for participants to give a response that explains their thinking and rationales for projects and solution finding. Regardless of participant answers, do not be critical of any responses. Rather, use Guiding

Questions to encourage participant solutions, searching for new knowledge and reflection.

Asking Guiding Questions:

- *Before an activity* helps participants focus their thoughts and efforts on solution finding as well as connect their prior knowledge to the challenge at hand.
- *During an activity* enables participants to evaluate steps taken and search for a solution.

- *After an activity* helps participants reflect and focus on solution variations and final explanations.

Examples of Guiding Question Starters include:

- What if....?
- In what ways might you...?
- How did...?
- Why does...?
- What might you...?

An activity's Guiding Questions are not all-encompassing. As conversation ensues, ask more questions to elicit further explanation. Note that Guiding Questions are not intended to prompt "Yes" or "No" responses; rather, encourage participants to give broader explanations of their thought processes. Guiding Questions can include content, process, and product questions.

DISCUSSION

Instructors may use an activity's Discussion section to further define or expand on information that relates to the activity. Discussion is an essential piece of an activity, designed to support learning. Although Discussion sections are placed at the end of session activities, they can occur at any point during activities. During an activity, Instructors

must decide when to engage participants in discussion to enhance learning. It is important to meet children at their level. If a discussion seems too advanced, change the language to match children's level of understanding, or let children ask questions and show you what they are interested in discovering.

INSTRUCTOR REFLECTION

Reflection exercises help children to experience, analyze, understand, and gain meaning from activities and classroom learning experiences. They provide productive processing time, which allows children to comprehend and understand new information. Many of the Guiding Questions prompt children to think about the work they accomplished during the program.

After challenging children to reflect, ask *yourself* the following questions:

- How would you change your approach if you had to teach this class again?
- What did you learn or understand about yourself and your teaching strategy throughout the program?

- What did you learn or remember about your teaching style that was successful?
- What was the most challenging aspect of child interaction in the classroom? Is there another coaching approach that would create a more positive learning environment?
- How can you use your classroom's physical space to further active learning?
- What was the most important piece of information you tried to teach children? What concept do you think stuck with children? What did you learn from the children?
- What other approaches could you have adopted to ensure that key concepts and objectives were met throughout the program?

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