

# Engineering - Technology Education

## S.T.E.M. - S.T.E.A.M. -S.T.R.E.A.M.S.

### Program Curriculum and Description

#### Overview

It is my pleasure to be part of the Mount Carmel Christian School family and it is an honor that you entrust your child to us for a few hours each day. The "Engineering Program" was introduced to MCCS in the fall of 2009 and implemented in stages over the next three years. The program is a guided hands-on, project based (PBL) learning experiences, created to improve students cognitive, affective, and psychomotor skills. Students are taught problem solving techniques and design processes (Engineering Design Process) that include content related to science, technology, reading, engineering, art, math, and social studies (S.T.R.E.A.M.S.). The goal is to assist students to advance from simple knowledge, to understanding, applying, analyzing, evaluating, ultimately to creative innovation and design (Bloom's Taxonomy).

The program is individualized to assess the current abilities of each child, their strengths, areas of improvement, learning styles and interest. I will work collaboratively with parents, students and the staff of Mount Carmel Christian for the success of each child. This will be done in a nurturing Christian environment with the best interest, safety, and development of each child as a priority.

The program goals are intended to...

- enrich your child's educational experience,
- open new doors for exploration,
- reinforce concepts taught in the core subjects,
- encourage exploration of new subjects,
- encourage and improve cooperative learning,
- develop work ethics and social skills,
- improve organizational skills,
- identify and avoid unsafe items and situations,
- improve communication skills,
- improve confidence, self-reliance, and independence,
- use problem solving and/or design process,
- progress from remembering information, to understanding concepts, to applying concepts, to analyzing problems, to evaluating results, to creating improved or new ideas, processes and/or products.
- improve critical thinking and problem solving ability,
- improve their ability to remember important information,
- understand science, math, and design concepts relevant to the projects,
- apply information and concepts in new situations,
- analyze material, data, products, etc.,
- evaluate the results implemented, and
- create new and improved ideas and products.

## What to Expect

Students in grades 3 – 8 are enrolled in the Engineering Program. The number of hours per week depends on the grade level. Classes meet on Tuesday, Thursday, or both Tuesday and Thursday. Each student will be issued a three ring binder in which to keep their work and a plastic storage box for small projects, parts, and personal items. The note book and storage box are stored in the lab, not taken home. When possible all projects are made from recyclable and/or reusable materials. Occasionally students may be requested to bring in recyclable items from home depending on the materials required for the project. These items are usually common in most homes (i.e. paper towel core tubes, liter soda bottles).

All students in the program learn the same processes at different levels with the difficulty of problems, projects, and class assignments based on the grade level and abilities of the individual students. Projects are selected based on the curriculum of the corresponding grade level, student interest, availability of resources, and safety. A list of sample projects will be provided, however the list is not all inclusive and may have items added or deleted as appropriate to the overall purpose of the program and the needs of students. The same projects are usually assigned to all students in the class. However, individual students may have projects assigned to meet learning abilities, accelerated capabilities, and those who have already completed the assignment.

Safety is a priority and I will not require a student to complete a task that I would not have allowed my own son or grandchild to complete. Research and learning activities may be completed at home with parental assistance. However, ALL projects and problems must be completed in class. Students must solve the problem or create the solution without assistance from parents or teachers so that they learn how to be independent and self-sufficient problem solvers.

Therefore, student records may include some assignments that have an asterisk (\*) entered. This simply indicates that the assignment was **not** required for your child to complete. An asterisk (\*) does not impact the calculation of the course average. If a grade is entered and also has a "subscript letter (a), (i), etc. the assignment is incomplete or the student was absent. These may have a negative impact on the student's average if not completed.

## Conduct

Students are expected to demonstrate Christian values and attributes. Therefore it is expected that students will...

- Respect the staff, visitors, guest, and their peers.
- Behave in a manner that does not disrupt or detract from their learning experience or that of other students.
- Will not cheat or commit any act that is immoral, unethical, and/or is illegal.
- Follow the verbal and written directions of the staff that apply to discipline and/or safety.
- Will comply with the consequences of misbehavior that may include, but not be limited to verbal reprimands, time out, detention, parent calls and/or parental conferences

E = Excellent - Student is self-disciplined at all times and needs no intervention.

S = Satisfactory - Student behaves age appropriately and when reminded, self corrects behavior

N = Needs Improvement - Student needs consequences or repeatedly demonstrates the same behavior.

U = Unsatisfactory - Repeated infractions with no effort to improve and parent conference required.

Parents are welcome to contact me by e-mail ([rmoore@mccsch.org](mailto:rmoore@mccsch.org)). Please be aware that I am in scheduled to be on-site only on Tuesdays and Thursday. I will return calls and requests as soon as possible and try to do so before the next scheduled class in which your child is enrolled.

## **Academic Assessment**

**Daily Grades = 50% of Semester Grade: Work Habits (50%) - Class Work/Activities (50%)**

**Students will demonstrate the following "Work Habits" daily.**

1. "On Time - On Task".
2. Respect the authority and peers and be cooperative individually and as a team member.
3. Follow written and verbal directions, procedures and rules.
4. Participate in all activities and attempt to complete all assignments.
5. Maintain a clean and organize work area, materials, tools, and lab.

**Students will be evaluated on their abilities to complete activities designed to teach them the required knowledge, concepts, safety, processes and skills that will enable them to solve problems, complete challenges and create new solutions. Students may receive assistance on these "Enabling Activities" from the teacher parents, peers and outside sources to...**

1. Learn the basic knowledge related to the problem.
2. Conduct research
3. Understand concepts and processes
4. Develop skills required to solve problems or create products.
5. Complete enabling activities that include but are not limited to worksheets, practice activities, individual assignments, games, teamwork, and homework.

**Test = 10% of Semester Grade: Evaluation techniques in this section are designed to evaluate the student's knowledge of subject and ability to remember content, explain concepts, identify tools, describe processes, interpret materials, etc. These will be conducted periodically without being announced or without assistance**

**Students will be able to...**

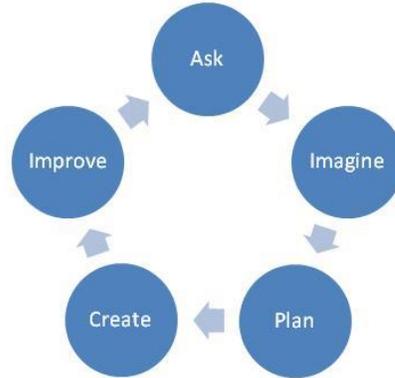
1. Demonstrate knowledge of subject content by answering questions of various types that include but are not limited to multiple choice, fill-in-the-blank, short answer, solving equations, and essay.
2. Demonstrate knowledge of subject related concepts by answering questions of various types that include but are not limited to multiple choice, fill-in-the-blank, short answer, solving equations, and essay.

**Project/Problem Challenge = 40%: This is the most critical evaluation of a student's progress in becoming a confident and independent creative problem solver. Assessment of a student's ability to solve problems in simulated and/or real world situations, analyze data, evaluate and create without assistance from adults.**

**Students will be able to...**

- Apply knowledge and skills to solve challenges and problems independently or in groups.

## The Engineering Design Process



### **Step 1: ASK - Problem Identification - Research - Remember - Understand**

When students are challenged to solve a given project or to identify a problem of interest, they will demonstrate their ability to...

1. Identify the problem and/or write a problem statement
2. Research the history of the problem
3. Identify and explain the scientific principles and mathematical equations related to the problem.
4. Answer important information, such as materials, function, tools, and etc., related to the problem after reading the challenge, data sheets, research, and related documents.
5. Identify and describe the existing technology and engineering designs related to the problem
6. Identify how describe how the problem relates to art, music, and other subjects
7. Describe how the problem is impacting our society and/or individuals.

### **Step 2: Imagine - Explore as many solutions as possible - Understand - Apply Concepts**

The second step is to imagine solutions to the problem using various techniques of brainstorming to identify as many creative solutions as possible. Depending on the problem, project, and objectives, students will work individually, in pairs, small groups, or as an entire class to develop solutions. Students will use existing criteria or develop their own criteria for the evaluation of possible solutions.

Students will be encouraged to consider...

- Alternative ideas
- The opinion of others
- Being creative
- Thinking outside of the existing solutions

Students will consider the following criteria based on the problem.

- Are the solution and/or design based on the specifications/criteria/needs stated in the problem?
- Were all of the possible solutions considered, compared and analyzed?
- Are the materials, tools and methods are available
- The cost of the materials and production processes

- Will the product be of good quality and be reliable?
- Will the product be safe for the intended users and not harm the environment?
- Will the disposal of the product have an impact on people, animals or the planet?
- Is the appearance of the solution important to the user?
- How does it impact ethical, social and cultural standards?
- How will the product be tested to determine effectiveness?

### **Step 3: Planning - Organizing - Prepping - Apply Concepts - Create**

Student will be required to develop a plan to implement the solution or create the designed product. The plan may include the following depending on grade level and the problem/project.

- Sketches/Drawings/Diagrams
- Materials list (Based on analysis of the materials available)
- Tools needed
- Type of construction, manufacturing and/or fabrication technology available
- Space requirements
- Order that tasks should be completed
- Who will be responsible for each task
- Safety
- Clear communications

### **Step 4: Create - Implement - Build - Construct - Print - Apply Concepts - Analyze**

Students will implement the solution and/or create a prototype of the product based on the plans. The use of **prototypes**, models or mock-ups help the student to understand the problem, identifying missing requirements, evaluate the solution/design, and improve the solution/design. Students will...

- Safely use the tools and processes required to implement the solution or create the prototype
- Implement the solution and/or create the prototype in class not at home
- Maintain all tools, materials, and workspaces in a neat, safe, and organized manner
- Work individually and/or cooperatively with peers
- Make adjustments in the plan as needed
- Document work progress
- Stay on task

### **Step 5: Improve - Analyze - Evaluate - Create**

Students will analyze and evaluate the solutions, processes, and designs to determine the effectiveness of their ideas. The students will then be working at the highest level of learning as they apply the changes to implement the solution or create the working product or process. Student will...

- Analyze the solution/prototype/process by testing and comparison to the identified problem
- Use pre-established criteria to conduct the analysis
- Evaluate the effectiveness of the solution/design/process
- Develop a plan to make improvements
- Implement or create the final solution/product/process

## **S.T.R.E.A.M.S.**

During my entire career I related the technology and process taught to the real world and other subject content. Within the last couple of years I gave in the acronym of STREAMS. Subjects are often taught in isolated classrooms with the emphasis on the subject content only. The "Engineering" program is designed to demonstrate how all subjects may be related to other subjects as they are in real life. Each subject is a stream of knowledge, concepts, ideas, solutions and each has an impact on our lives. These streams of life are made of all of subjects feeding into the river of life that makes us who we are. As you read through the Engineering Design Process you will be able to identify how each subject is interwoven into engineering and technology education.

Science - Students will demonstrate and apply the scientific principles that apply to each project. This enhances the student's ability to discover the concepts God used to create the world and all that is in it from things that were unseen.

Technology Education - Students will have the opportunity to learn how the ability of humans to create and use tools and processes to change the natural resources into products that enhance our lives. Students will apply available technology that includes, hand tools, power tools, machines, computers, and processes to build and/or create items.

Reading - Students will be taught "Technical Reading Skills". Reading is a fundamental skill that greatly determines an individual's ability to be successful in our current society. All students are taught to read paragraphs, novels, short stories and simple directions in the core subjects. When working with technology and engineering content students must develop the ability to read detailed and often complicated material that is not easy for them to then communicate or apply without being taught how to read technical information.

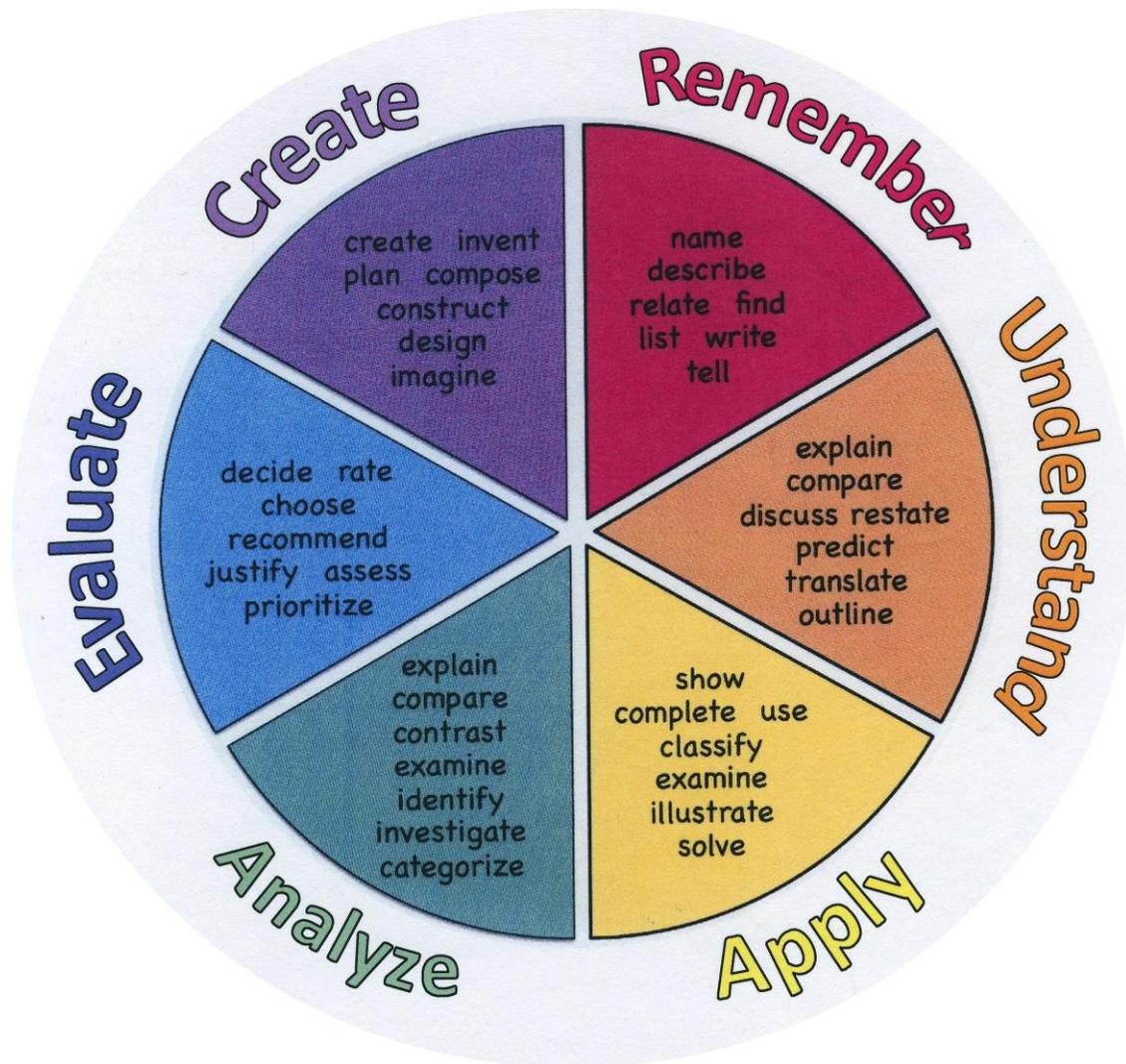
Engineering - Students will demonstrate their ability to use the Engineering Design Process to solve challenging problems. Students will demonstrate their ability to be innovative and creative as they apply science, math, and technology to new challenges.

Art - This includes all of the "Fine Arts". Engineering and technology are intricate to the creation of art and music. The design, improvement and creation of paints, brushes, canvas, processes, musical instruments, sound and video production are engineering and technology. Novels, short stories, movies, and dramas often include materials about technology and engineering. Art and music are important to our lives and have been in all societies and cultures.

Math - Our world is often described and explained using numbers and mathematical formulas. Without math engineering and technology would not have advanced to the level that exists today. The level of mathematics that each student will need depends on their future careers. Our task is to prepare all students with the highest level of mathematical ability.

Social Sciences - Students will demonstrate how engineering and technology have affected history, changes in culture, and human behavior. They will conduct research on what has been done in the past and the progression of applied knowledge that has lead to the current level of technology and the way we live. Social studies also include our behavior, how we interact with our world and other people. Christian principles and values are what we teach and want students to comprehend the principles and beliefs in order to develop a personal relationship with Christ.

Bloom's Taxonomy



My Goal is for your child and every child who enters my classroom and Mount Carmel Christian School to be able to become what God has planned for them. This includes assisting them in being confident in their ability to attempt challenging problems with creative innovations without fear of failure in areas of interest.

Rick Moore

*"For we walk by FAITH, not by SIGHT" II Corinthians 5:7*