

Fair Lawn Public Schools

Fair Lawn, NJ

Technical
Architecture
& Design

August

2015

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Developed August 2015

The focus of the Engineering and Technology Department is to promote the development of **innovation** skills in all students. This is an intermediate course in which students will study and apply the innovation process.

**Engineering &
Technology
Education**

Learn. Innovation.

Fair Lawn School District

Committee Credits

Written By

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Architecture & Design

I. Course Synopsis

Architecture & Design is an intermediate course in which students will study and apply the design process, with a focus on architectural history & theory.

II. Philosophy & Rationale

This course has been aligned to and developed with the [NJCCCS for Technology](#) as it's major focus, with a supplemental focus on the [Standards for Technological Literacy for the Content Study of Technology](#) (ITEA). In addition, the Next Generation Science Standards, particularly in [physical science](#) and [engineering and design](#) have been addressed along with the CCCS for [literacy in science and technical](#) subjects and [math](#). This demonstrates the integral nature of engineering into "STEM" education.

"Innovation" is defined as *the act or process of introducing new ideas, devices, or methods*". The philosophy of the Engineering and Technology Department to focus on the development of innovation in all students through the application of true, STEM education.

Differentiated instruction for students at different levels of achievement and specific learning needs (e.g. special education, English Language Learners (ELL), at-risk, and Gifted & Talented) is embedded in targeted scaffolding based on knowledge of each student's interests, needs, and assessment data, including, but not limited to, in class formative and summative assessments. Students in these courses are provided with clear, concise rubrics which describe and define expectations for project based, authentic assessment which involves written and/or performance based requirements.

When deemed appropriate, department teachers will engage students in purposeful paired discussions to share information more effectively, such as the "turn and talk" (Harvey & Daniels, 2009). "Text annotation" could be used, for example to optimize reading comprehension (Daniels & Steineke, 2010).

III. Scope & Sequence

Innovation & Invention serves as an intermediate course in which students will develop and apply their skills of design using CADD to electronics, modeling, fabrication, product development and basic robotics.

Unit 1: Engineering Safely (September)

- The safe use of tools, equipment and machines is essential for effectively applying the engineering process.

Unit 2: Design and Invention Process (September- October)

- The design loop can be applied to continually improve upon their designs and ideas.
- The patents process protects an engineer's ideas.

Unit 3: Developing Engineering Skills (October - December)

- Engineers use detailed computer programs to create accurate schematics.
- Engineers must read schematics drawn in different perspectives.
- The collaborative thought processes allows for more creative solutions.

Unit 4: Simple Machines (January - February)

- A simple machine decreases the amount of force needed to accomplish a goal.
- Multiple simple machines working together create a device.

Unit 5: Reverse Engineering (February - April)

- Many subsystems make whole working machine.
- Differences in design affect the quality of the product.

Unit 6: Marketing and Presentation (May - June)

- Research is an essential component to good engineering.
- Engineering is driven by cost effectiveness and market needs.

IV. Unit Descriptions

Unit 1: History and Theory of Architecture (September)

Enduring Understandings

1. Architecture is a living breathing thing that has been around since people have.
2. Buildings can invoke emotions and feelings based off the style in which they were designed.

Essential Questions:

1. How are buildings designed?
2. How do architects use the design process in their thinking?

Learning Objectives:

1. Understand how the components of architectural theory have changed over time.
8.2.12.B.5
2. Explain the connection between form and function and the importance of form as they relate to the theory of architecture.

Suggested Activities & Suggested Modifications for Special Education Students, ELL Students, Students at Risk, and Gifted Students:

1. Building design project.
2. Modifications may include providing students with a template, diagrams, and additional resources for special education and ELL students.
3. Gifted students may be asked to assist their classmates in tool, equipment and machine identification.

Cross-Content Connections:

[Standards for Technology Literacy \(9-12\)](#)– 7: Role of Technology on History

Common Core Standards for English & Technical Subjects: [9-10](#); [11-12](#):

A focus in this unit will be following multistep processes.

***Safety will be stressed and monitored throughout the course.**

Unit 2: Tools of the Trade (October-November)

Enduring Understandings

1. What CAD, Technical Drawing, and 3D modeling are and what they are for.
2. How mapping your ideas lets you refine them to exactly what you want.

Essential Questions:

1. Which program do you use in what phase of the design process?
2. What is the relationship between speed and efficiency and why is it so important?

Learning Objectives:

1. Apply current technologies to the design process. **8.2.12.D.1, 8.2.12.D.3**
2. Use current technologies to refine the design process.

Suggested Activities & Suggested Modifications for Special Education Students, ELL Students, Students at Risk, and Gifted Students:

1. Modifications may include providing students with a template or to support the process and/or design specifications with reduced variables.
2. Gifted students may be asked to complete additional steps or address additional variables.

Cross-Content Connections:

[Standards for Technology Literacy \(9-12\)](#) – **11: Applying the Design Process; 19: Manufacturing Technologies**

Next Generation Science Standards - A focus in this unit will be on the [Real world applications of technology](#) (HS-ETS).

Common Core Standards for English & Technical Subjects: [9-10](#); [11-12](#):

A focus in this unit will be following multistep processes, key idea development and craft/structure.

Common Core Standards for Math:

A focus in this unit will be on [geometry](#), particularly the use of right triangles.

A focus in this unit will be on [numbers and quantities](#), particularly for the use of measurement.

Unit 3: Understanding Building Design (November - December)

Enduring Understandings

1. Why buildings take a certain form.
2. How building envelopes work with the interior conditions.

Essential Questions:

1. How does a building envelope work?
2. How do aesthetic considerations change building form?

Learning Objectives:

1. Demonstrate a working understanding of the basics of building design. **8.2.12.D.1**
2. Demonstrate a working understanding of the basics of building development.

Suggested Activities & Suggested Modifications for Special Education Students, ELL Students, Students at Risk, and Gifted Students:

1. Modifications may include providing students with a template or to support the process and/or design specifications with reduced variables.
2. Gifted students may be asked to complete additional steps or address additional variables.

Cross-Content Connections:

[Standards for Technology Literacy \(9-12\)](#) – 8: Attributes of Design; 5: Troubleshooting

Next Generation Science Standards - A focus in this unit will be on the

[Real world applications of technology](#) (HS-ETS).

Common Core Standards for English & Technical Subjects: [9-10](#); [11-12](#):

A focus in this unit will be following multistep processes, key idea development and craft/structure.

Common Core Standards for Math:

A focus in this unit will be on [geometry](#), particularly the use of right triangles.

A focus in this unit will be on [numbers and quantities](#), particularly for the use of measurement.

Unit 4: Advanced Concepts of Building Design (January-February)

Enduring Understandings

1. How design changes with project specific parameters.
2. Why all-encompassing standards and restrictions are so vital and what they accomplish.

Essential Questions:

1. How do codes, site demands, and engineering shape structures?
2. What are graphic standards and how do they affect us?

Learning Objectives:

1. Understand the apply various limitations and restrictions on building design. **8.2.12.D.1**

Suggested Activities & Suggested Modifications for Special Education Students, ELL Students, Students at Risk, and Gifted Students:

1. Modifications may include providing students with a template or to support the process and/or design specifications with reduced variables and steps.
2. Gifted students may be asked to complete additional steps or address additional variables.

Cross-Content Connections:

[Standards for Technology Literacy \(9-12\)](#) – 8: Attributes of Design; 5: Troubleshooting

Next Generation Science Standards - A focus in this unit will be on the

[Real world applications of technology](#) (HS-ETS).

[Energy \(HS-PS\)](#), [Forces \(HS-PS\)](#)

Common Core Standards for English & Technical Subjects: [9-10](#); [11-12](#):

A focus in this unit will be following multistep processes, key idea development and craft/structure.

Common Core Standards for Math:

A focus in this unit will be on [geometry](#), particularly the use of right triangles.

A focus in this unit will be on [numbers and quantities](#), particularly for the use of measurement.

Unit 5: Advanced Model Making (March-April)

Enduring Understanding

1. How model making is such an effective prototyping method.
2. Best practice methods for quick model making.

Essential Questions:

1. Why does model making work on such varying scales?

Learning Objectives:

1. Apply content from the course to create models based on architectural theory.
8.2.12.D.1

Suggested Activities & Suggested Modifications for Special Education Students, ELL Students, Students at Risk, and Gifted Students:

1. Modifications may include providing students with a template or to support the process and/or design specifications with reduced variables and steps.
2. Gifted students may be asked to complete additional steps or address additional variables.

Cross-Content Connections:

[Standards for Technology Literacy \(9-12\)](#) -- **8: Attributes of Design; 5: Troubleshooting**

Next Generation Science Standards - A focus in this unit will be on the

[Real world applications of technology](#) (HS-ETS).

Common Core Standards for English & Technical Subjects: [9-10](#); [11-12](#):

A focus in this unit will be following multistep processes, key idea development and craft/structure.

Common Core Standards for Math:

A focus in this unit will be on [geometry](#), particularly the use of right triangles.

A focus in this unit will be on [numbers and quantities](#), particularly for the use of measurement.

Unit 6: Final Design Studio (May-June)

Enduring Understanding

1. The design process is highly important and specific tool in building design.
2. How all different process elements and outside influences change the final design.

Essential Questions:

1. How can you create a functioning design while satisfying all parameters and your own design objectives and aesthetics?

Learning Objectives:

1. Apply content from course for a culminating project through the use of a digital and physical portfolio. (8.1.12.A.1)

Suggested Activities & Suggested Modifications for Special Education Students, ELL Students,

1. Modifications may include providing students with a template or to support the process and/or design specifications with reduced variables and steps.
2. Gifted students may be asked to complete additional steps or address additional variables.

Cross-Content Connections:

[Standards for Technology Literacy \(9-12\)](#) – 8: Attributes of Design; 5: Troubleshooting

Next Generation Science Standards - A focus in this unit will be on the

[Real world applications of technology](#) (HS-ETS).

Common Core Standards for English & Technical Subjects: [9-10](#); [11-12](#):

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Common Core Standards for Math:

A focus in this unit will be on [geometry](#), particularly the use of right triangles.

A focus in this unit will be on [numbers and quantities](#), particularly for the use of measurement.

V. Course Materials

Core (Required) Texts

Technology Engineering & Design (2008) Pearson
Will be used as a classroom reference book.

Understanding Technology (1993) Goodheart-Wilcox
Will be used as a classroom reference book.

VI. Assessments

Classroom assessments are included to primarily guide instruction (formative assessment) and to support decisions made beyond the classroom (summative assessment).

Summative assessment will be authentic in nature. Students will be asked to complete design challenges and other performance based assessments. These assignments will typically involve a design, build, test, and redesign competent.

VII. Interdisciplinary Connections and Alignment to Technology Standards

Interdisciplinary connections have been noted within each unit in the previous pages.

Careful attention will be paid in this course to form meaningful connections between the application of literacy for technical subjects, math skills and standards, career exploration, and the Next Generation Science Standards.

Engineering & Technology Education classes in the Fair Lawn Public schools promote career-readiness skills related to Personal Financial Literacy (9.1) and Career Awareness, Exploration, and Presentation (9.2). Some course concepts from the Career and Technical Education Standards (9.3), but these are not directly correlated since our district is not a CTE program.

The Fair Lawn Public Schools District fosters an environment that promotes career-readiness skills in all content areas. Whereas [Career Ready Practices](#) are explored consistently, specific alignment to [Personal Finance Literacy \(9.1\)](#) and [Career Awareness, Exploration, and Presentation Standards \(9.2\)](#) are included in the district level document (below). When appropriate, the [Career and Technical Education Standards \(9.3\)](#) have been reviewed and aligned as well.

Examples: 9.2B: Career exploration in each unit of study.

In addition, every effort is made to integrate technology and engineering into our science classes. [Educational Technology \(8.1\)](#) and [Technology Education, Engineering, Design, and Computational Thinking – Programming \(8.2\)](#) standards are cross connected throughout our science programs.

- Examples:
- 8.1A: Use spreadsheets to analyze & interpret data from laboratories, 6-12.
Use the internet to increase productivity and efficiency, 9-12.
 - 8.1B,C: Use data to solve real-world problems, 6-12.
Use online platforms to collaborate & address global issues, 9-12.
 - 8.1F: Collect and analyze data using internet and data simulations, 6-12.
 - 8.2A: Become aware of the invention process, 3-5.
 - 8.2B: Become aware of the global impacts on technology, 6-12.
 - 8.2C: Apply the design process to pushes & pulls, K-2.
 - 8.2D: Use tools to reduce work, K-2.

For additional detail on how these standards are integrated throughout the Fair Lawn Schools curriculum, review the Fair Lawn Public Schools District Alignment to Technology & Career Readiness & 21st Century Skills Standards Curriculum Appendix.