# Verona Public School District
# Curriculum Overview

## CompSci 7:  3D Modeling/T.E.D.

**Curriculum Committee Members:**
Andor Kish

**Supervisor:**
Glen Stevenson

**Curriculum Developed:**
Summer 2015
Summer 2018

**Board Approval Date:**
October 20, 2015
October 9, 2018

**Verona Public Schools**
**121 Fairview Ave., Verona, NJ 07044**
**www.veronaschools.org**

**Verona Public Schools Mission Statement:**

In partnership with a supportive community, we inspire our students to be creative, critical thinkers and compassionate global citizens through dynamic teaching, meaningful curricula, and enriching experiences.

**Course Description:**

Students will learn the basic principles of 3D design, modeling, and virtual reality (VR). Students will engage in a course that takes them through the elements of TinkerCAD, CoSpaces, and Google VR. Students will have the ability to learn and use a 3D printer, as well as, 360 degree photos to create VR.

**Prerequisite(s):**

Fifth Grade Intro to Computers and Sixth Grade Intro to Coding.

# H.B. Whitehorne CompSci 7: 3D Modeling/T.E.D.

## Standard 8: Technology Standards

| **8.1: Educational Technology:** *All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.* | **8.2: Technology Education, Engineering, Design, and Computational Thinking - Programming:** *All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.* |
|---|---|
| **X** A. Technology Operations and Concepts<br>**X** B. Creativity and Innovation<br>**X** C. Communication and Collaboration<br>**X** D. Digital Citizenship<br>**X** E. Research and Information Fluency<br>**X** F. Critical thinking, problem solving, and decision making | **X** A. The Nature of Technology: Creativity and Innovation<br>**X** B. Technology and Society<br>**X** C. Design<br>**X** D. Abilities for a Technological World<br>**X** E. Computational Thinking: Programming |

## SEL Competencies and Career Ready Practices

| **Social and Emotional Learning Core Competencies:** *These competencies are identified as five interrelated sets of cognitive, affective, and behavioral capabilities* | **Career Ready Practices:** *These practices outline the skills that all individuals need to have to truly be adaptable, reflective, and proactive in life and careers. These are researched practices that are essential to career readiness.* |
|---|---|
| **Self-awareness:** The ability to accurately recognize one's emotions and thoughts and their influence on behavior. This includes accurately assessing one's strengths and limitations and possessing a well-grounded sense of confidence and optimism. | **X** CRP2. Apply appropriate academic and technical skills.<br>CRP9. Model integrity, ethical leadership, and effective management.<br>CRP10. Plan education and career paths aligned to personal goals. |
| **Self-management:** The ability to regulate one's emotions, thoughts, and behaviors effectively in different situations. This includes managing stress, controlling impulses, motivating oneself, and setting and working toward achieving personal and academic goals. | CRP3. Attend to personal health and financial well-being.<br>**X** CRP6. Demonstrate creativity and innovation.<br>**X** CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.<br>**X** CRP11. Use technology to enhance productivity. |
| **Social awareness:** The ability to take the perspective of and empathize with others from diverse backgrounds and cultures, to understand social and ethical norms for behavior, and to recognize family, school, and community resources and supports. | CRP1. Act as a responsible and contributing citizen and employee.<br>CRP9. Model integrity, ethical leadership, and effective management. |
| **Relationship skills:** The ability to establish and maintain healthy and rewarding relationships with diverse individuals and groups. This includes communicating clearly, listening actively, cooperating, resisting inappropriate social pressure, negotiating conflict constructively, and seeking and offering help when needed. | **X** CRP4. Communicate clearly and effectively and with reason.<br>CRP9. Model integrity, ethical leadership, and effective management.<br>**X** CRP12. Work productively in teams while using cultural global competence. |
| **Responsible decision making:** The ability to make constructive and respectful choices about personal behavior and social interactions based on consideration of ethical standards, safety concerns, social norms, the realistic evaluation of consequences of various actions, and the well-being of self and others. | **X** CRP5. Consider the environmental, social, and economic impact of decisions.<br>**X** CRP7. Employ valid and reliable research strategies.<br>**X** CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.<br>CRP9. Model integrity, ethical leadership, and effective management. |

## Standard 9: 21st Century Life and Careers

| **9.1: Personal Financial Literacy:** *This standard outlines the important fiscal knowledge, habits, and skills that must be mastered in order for students to make informed decisions about personal finance. Financial literacy is an integral component of a student's college and career readiness, enabling students to achieve fulfilling, financially-secure, and successful careers.* | **9.2: Career Awareness, Exploration & Preparation:** *This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.* | **9.3: Career and Technical Education:** *This standard outlines what students should know and be able to do upon completion of a CTE Program of Study.* |
|---|---|---|
| A. Income and Careers<br>B. Money Management<br>C. Credit and Debt Management<br>D. Planning, Saving, and Investing<br>**X** E. Becoming a Critical Consumer<br>F. Civic Financial Responsibility<br>G. Insuring and Protecting | A. Career Awareness (K-4)<br>**X** B. Career Exploration (5-8)<br>C. Career Preparation (9-12) | A. Agriculture, Food & Natural Res.<br>B. Architecture & Construction<br>C. Arts, A/V Technology & Comm.<br>D. Business Management & Admin.<br>E. Education & Training<br>F. Finance<br>G. Government & Public Admin.<br>H. Health Science<br>I. Hospital & Tourism<br>J. Human Services<br>**X** K. Information Technology<br>L. Law, Public, Safety, Corrections & Security<br>M. Manufacturing<br>N. Marketing<br>**X** O. Science, Technology, Engineering & Math<br>P. Transportation, Distribution & Log. |

## Course Materials

| **Core Instructional Materials**: *These are the board adopted and approved materials to support the curriculum, instruction, and assessment of this course.* | **Differentiated Resources**: *These are teacher and department found materials, and also approved support materials that facilitate differentiation of curriculum, instruction, and assessment of this course.* |
|---|---|
| • **TinkerCAD**<br>• **CoSpaces**<br>• **Google VR Tours**<br>• **VR viewers**<br>• **Paint.net** | • |

# H.B. Whitehorne CompSci 7: 3D Modeling/T.E.D.

| Unit 1: Intro to TinkerCAD | Unit Duration: 7 days |
|---|---|

## Stage 1: Desired Results

### Established Goals:

8.2.8.C.1 Explain how different teams/groups can contribute to the overall design of a product.
8.2.8.C.2 Explain the need for optimization in a design process.
8.2.8.C.3 Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.
8.2.8.C.4 Identify the steps in the design process that would be used to solve a designated problem.
8.2.8.C.5 Explain the interdependence of a subsystem that operates as part of a system. Create a technical sketch of a product with materials and measurements labeled
8.2.8.D.1 Design and create a product that addresses a real world problem using a design process under specific constraints.
8.2.8.D.2 Identify the design constraints and trade-offs involved in designing a prototype (e.g., how the prototype might fail and how it might be improved) by completing a design problem and reporting results in a multimedia presentation, design portfolio or engineering notebook.
8.2.8.D.3 Build a prototype that meets a STEM-based design challenge using science, engineering, and math principles that validate a solution
8.2.8.E.1 Identify ways computers are used that have had an impact across the range of human activity and within different careers where they are used.
8.2.8.E.2 Demonstrate an understanding of the relationship between hardware and software.

**ISTE Standards:**

**1. Creativity and innovation**
Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.
a. Apply existing knowledge to generate new ideas, products, or processes
b. Create original works as a means of personal or group expression
c. Use models and simulations to explore complex systems and issues
d. Identify trends and forecast possibilities

**2. Communication and collaboration**
Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
a. Interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media
b. Communicate information and ideas effectively to multiple audiences using a variety of media and formats
c. Develop cultural understanding and global awareness by engaging with learners of other cultures
d. Contribute to project teams to produce original works or solve problems

**4. Critical thinking, problem solving,and decision making Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.**
a. Identify and define authentic problems and significant questions for investigation
b. Plan and manage activities to develop a solution or complete a project
c. Collect and analyze data to identify solutions and/or make informed decisions
d. Use multiple processes and diverse perspectives to explore alternative solutions

**6. Technology operations and concepts**
Students demonstrate a sound understanding of technology concepts, systems, and operations.
a. Understand and use technology systems
b. Select and use applications effectively and productively
c. Troubleshoot systems and applications
d. Transfer current knowledge to learning of new technologies

### Transfer Goal:

Students will be able to <u>independently</u> use their learning to…

manipulate and transform objects around the workplane using the tools, inspector, axes, translating, and grouping to create a 3D object.

### Students will understand that:

- the 3D world works on a x, y, and z axis
- scaling and translating an object resizes and rotates an object.
- scaling and rotating at the same time skews an object.
- Boolean operations take place on two levels; addition and subtraction.
- positive and negative space is a key component in composing 3D objects.

### Essential Questions:

- What is a workplane or workspace?
- How can zooming in and/or out be beneficial?
- How can zooming in and/or out be unbeneficial?
- How can rotating be beneficial?
- How can rotating be unbeneficial?
- What is it meant to scale?
- What does it mean to be skew?

### Students will know:

- the workplane is essentially graph paper.
- the snap grid view increases or decreases the scaling of the workplane.
- TinkerCAD uses the metric system
- rotating and zooming will help you change the view of the workplane
- the inspector window contains all of the objects, shapes, and tools to create a 3D shape.
- the Boolean operation is combining two or more objects into one new object.
- the workplane and TinkerCAD can be easily manipulated using shortcuts, just like other programs.
- the Home button zooms out/into the default view of the workplane.
- the x,y,z axis is controlled using the arrows on the menu (also other keyboard shortcuts).
- the Snap Grid is used to nudge an object a certain distance.
- the grouping of shapes can be undone.
- the grouping of objects is called nesting groups.
- the creating of an hole in an object is done by nesting objects.

### Students will be able to:

- identify the various menus and inspectors of TinkerCAD.
- identify how to edit the Snap Grid.
- distinguish between the x, y, and z axis.
- distinguish between groups and nesting groups.
- distinguish between an regular and skewed object.
- distinguish between rotation, scaling, and moving points on an object.

## Stage 2: Acceptable Evidence

### Transfer Task

Students will have to complete a few different tasks to show that they have mastered the basics of TinkerCAD. The students will have to:

- demonstrate their ability to work around the workplane using the tools and inspector by being given a number of tasks.
- create a heart outline that has an hollow inside. (students will have to use the grouping and hole tool to the best of their ability)
- create a castle that uses all of the basic workspace, inspector, and shortcut functions.

| Unit 2: Creating Everyday Objects 1.0 | Unit Duration: 6 days |
|---|---|

# Stage 1: Desired Results

## Established Goals:

Summarize and describe distributions.
CCSS.M.6.SP.B.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots.
CCSS.M.6.SP.B.5 Summarize numerical data sets in relation to their context, such as by:
CCSS.M.6.SP.B.5.A Reporting the number of observations.
CCSS.M.6.SP.B.5.B Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.
8.2.8.C.1 Explain how different teams/groups can contribute to the overall design of a product.
8.2.8.C.2 Explain the need for optimization in a design process.
8.2.8.C.3 Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.
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8.2.8.E.1 Identify ways computers are used that have had an impact across the range of human activity and within different careers where they are used.
8.2.8.E.2 Demonstrate an understanding of the relationship between hardware and software.

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**4. Critical thinking, problem solving,and decision making Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.**
a. Identify and define authentic problems and significant questions for investigation
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d. Use multiple processes and diverse perspectives to explore alternative solutions

**6. Technology operations and concepts**
Students demonstrate a sound understanding of technology concepts, systems, and operations.
a. Understand and use technology systems
b. Select and use applications effectively and productively
c. Troubleshoot systems and applications
d. Transfer current knowledge to learning of new technologies

## Transfer Goal:

Students will be able to <u>independently</u> use their learning to…
create and reinforce the foundational skills of Tinkercad including creating objects, importing files, moving objects, scaling objects and working with the canvas. The project starts with a very basic lesson (creating a button) that introduces how to create objects, cut holes and group. The lesson begins to add levels of freedom by allowing students to customize objects, create a stamp with a pattern of their own design and finally solve an open-ended challenge problems.

## Students will understand that:

- Modify existing objects to their own specifications
- 3D printers impose constraints when printing
- Importing a two-dimensional file to make a custom shape can only be of certain file extensions
- The user's perspective, in creating a shape, varies from creator to creator

## Essential Questions:

- How do you go about planning/brainstorming?
- How can you identify the different move, scale, and rotate handles?
- What does it mean to have artistic license?
- What is an example of intrusion?
- What is an example of extrusion?

## Students will know:

- the extrusion tool gives depth to a 2D shape.
- the planning and brainstorming process are crucial to a successful design
- a 3D printer prints an hollow object by default, but this can be changed in the printer density settings.
- the proper handles to modify an object.
- the align tool will align multiple objects along the x, y, and z axis.
- the ruler allows precision along the workplane.
- the extrusion tool to create objects of your own.

## Students will be able to:

- Create objects using shape primitives, letters and imported STL files
- Move, scale and rotate objects using handles
- Scale objects using the ruler
- Pan the camera in, out and around the model
- Group objects to make holes
- Plan how to create simple objects
- identify with the extrusion tool
- distinguish between proper handles to modify an object
- identify how to align multiple objects along the x, y, and z axis
- identify how to create a successful planning and brainstorming process

# Stage 2: Acceptable Evidence

## Transfer Task

Students will have to complete a few different tasks. These tasks require the students to create the following everyday objects.

- Students will have to create their own logos..
- Students will have to create a trick die in which one side will be weight to have the same number appear on top each time. Students will also learn the printing process at this point.
- Students will design and create a spoon (utensil) that will be cost saving for HBW.

| Unit 3: Creating a Scene in CoSpaces | Unit Duration: 10 days |
|---|---|

# Stage 1: Desired Results

## Established Goals:

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**4. Critical thinking, problem solving,and decision making Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.**
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Students demonstrate a sound understanding of technology concepts, systems, and operations.
a. Understand and use technology systems
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## Transfer Goal:

Students will be able to <u>independently</u> use their learning to…

create and reinforce the foundational skills of CoSpaces including creating objects, importing files, moving objects, scaling objects and working with the canvas in a virtual world. The lesson will go over the basic and intermediate steps to Virtual Reality and Augmented Reality.

## Students will understand that:

- The camera is a vital tool that is used in VR/AR.
- The camera has 4 different modes (walk, orbit, fixed, and fly)
- VR/AR is a combination of 3D design and coding.
- The design process is free flowing and not stagnant.

## Essential Questions:

- How is the camera used in VR and AR and why is it a crucial tool?
- How do you take constructive criticism into planning, designing, and reworking objects?

## Students will know:

- CoSpaces has limitations and how to work around these limitations.
- How to use hotkeys
- Importing files is a great way to work around limitations
- the introduction of new tools that are not found in TinkerCAD.
- how to navigate on a desktop and on a mobile device
- how the camera works and how it is crucial to setting up a scene

## Students will be able to:

- identify the limitations of CoSpaces and how to work around them, i.e. importing files
- identify the differences between the four camera modes.
- identify how code and 3D modeling aide one another.
- Identify similar tools that exist in TinkerCAD and CoSpaces, e.g., snapping to a grid
- Make use of the hotkeys that are embedded within CoSpaces.

# Stage 2: Acceptable Evidence

## Transfer Task

Students will have to complete a few different tasks. These tasks require the students to create the following everyday objects.

- Students will have to animate characters.
- Students will have to create an object in TinkerCAD and import it to CoSpaces.
- Students will create a VR game of their liking. Think PacMan in VR. .
- Students will create a scene, of their liking, that must be animated, use different styles of cameras, have at least one imported file, have code that goes along with it, and must be able to work on a desktop and on a mobile device in VR.

| Unit 4: Google VR Tour | Unit Duration: 7 days |
|---|---|

# Stage 1: Desired Results

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## Transfer Goal:

Students will be able to <u>independently</u> use their learning to…

create a VR tour using Google VR Tour creator.. Students will use a combination of 360 degree photos and storytelling during their tour.

| Students will understand that: | Essential Questions: |
|---|---|
| ● working with multiple programs to achieve results is commonplace.<br>● Audio, text, and 360 photos comprise a scene.<br>● designing individual parts is part of the whole process.<br>● Digital storytelling is much like traditional storytelling. | ● What are some instances where an individual is part of a whole?<br>● How have you gone back to the drawing board before?<br>● How have you worked with multiple resources to achieve a final result? |
| **Students will know:** | **Students will be able to:** |
| ● how to take their very own 360 photos using Google Street View<br>● how to import their own photos.<br>● that audio is a vital part of digital storytelling<br>● How to apply ambient sounds and scene narration | ● Create 360 photos.<br>● Narrate their own audio using a variety of programs. .<br>● Distinguish between a POI (point of interest) and a scene overlay. .<br>● Comprise a scene that tells a story or has important information<br>● Publish and share their tour for VR use. |

# Stage 2: Acceptable Evidence

## Transfer Task

Students will have to create a VR Tour of HBW (think of a tour that would help during Back to School Night). Students will have to pick what are the Points of Interest at HBW and then take 360 photos of those POI. Students will also create audio narration that accompanies their 360 photos and also incorporate ambient sound that is relevant for each POI.

# H.B. Whitehorne CompSci 7: 3D Modeling/T.E.D.

| Unit 5: Final Project | Unit Duration: 10 days |
|---|---|

## Stage 1: Desired Results

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d. Transfer current knowledge to learning of new technologies

### Transfer Goal:

Students will be able to <u>independently</u> use their learning to…

plan, design, and create a 3D model of their own using previous lessons and skills.

| Students will understand that: | Essential Questions: |
|---|---|
| ● budgeting time is a crucial part of the process.<br>● having a clear objective and goal makes the build process easier<br>● having more hands in the project can be a pro and con. (working with multiple people) | ● How do small teams of engineers or developers coordinate an activity?<br>● How do you overcome obstacles in your way?<br>● What are some challenges you would face if working by yourself?<br>● What are some challenges you would face if working as a group? |
| **Students will know:** | **Students will be able to:** |
| ● how to stick to a strict timeline when creating their models.<br>● the planning and design process are essential and the most important.<br>● how to deal with failure.<br>● how periodical check-ins can help in the build process. | ● envision their creation and then create it.<br>● identify ways to budget their time.<br>● identify which part(s) of their project will be most challenging.<br>● distinguish between being stuck and failure.<br>● identify each stay of their design process to ensure success. |

## Stage 2: Acceptable Evidence

### Transfer Task

Students will create an object of their own liking, within certain parameters, as a final project. The project will have to be approved before being built. A blueprint and complete design process submission will be required. This gives the students total freedom to create whatever it is that they would like and take what they have learned and implement it in their own way and fashion. They will have the option of working by themselves or with a partner(s).