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:

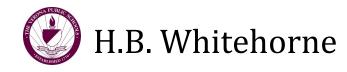
In partnership with a supportive community, we inspire our students to be creative, critical thinkers and compassionate global citizens through dynamic teaching, meaningful curricula, and enriching experiences.

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.



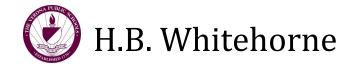
Standard 8: Technology Standards		
8.1: Educational Technology: All students will use digital tools to access, manage,	8.2: Technology Education, Engineering, Design, and Computational Thinking -	
evaluate, and synthesize information in order to solve problems individually and	Programming: All students will develop an understanding of the nature and impact of technology,	
collaborate and to create and communicate knowledge.	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	X A. The Nature of Technology: Creativity and Innovation	
X B. Creativity and Innovation	X B. Technology and Society	
X C. Communication and Collaboration	X C. Design	
X D. Digital Citizenship	X D. Abilities for a Technological World	
X E. Research and Information Fluency	X E. Computational Thinking: Programming	
X F. Critical thinking, problem solving, and decision making		

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

Standard 9: 21 st 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 B. Money Management C. Credit and Debt Management D. Planning, Saving, and Investing X E. Becoming a Critical Consumer F. Civic Financial Responsibility G. Insuring and Protecting 	A. Career Awareness (K-4) X B. Career Exploration (5-8) C. Career Preparation (9-12)	 A. Agriculture, Food & Natural Res. B. Architecture & Construction C. Arts, A/V Technology & Comm. D. Business Management & Admin. E. Education & Training F. Finance G. Government & Public Admin. H. Health Science I. Hospital & Tourism J. Human Services X K. Information Technology L. Law, Public, Safety, Corrections & Security M. Marketing X O. Science, Technology, Engineering & Math P. Transportation, Distribution & Log.

Course Materials Core Instructional Materials: These are the board adopted and approved materials to support Differentiated Resources: These are teacher and department found materials, and also

the curriculum, instruction, and assessment of this course.	approved support materials that facilitate differentiation of curriculum, instruction, and assessment of this course.
TinkerCAD	•
CoSpaces	
Google VR Tours	
VR viewers	
Paint.net	



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.

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- 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 independently 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:	Essential Questions:
 the 3D world works on a x, y, and z axis 	 What is a workplane or workspace?
 scaling and translating an object resizes and rotates an object. 	 How can zooming in and/or out be beneficial?
 scaling and rotating at the same time skews an object. 	 How can zooming in and/or out be unbeneficial?
 Boolean operations take place on two levels; addition and subtraction. 	 How can rotating be beneficial?
 positive and negative space is a key component in composing 3D objects. 	 How can rotating be unbeneficial?
	What is it meant to scale?
	What does it mean to be skew?
Students will know:	Students will be able to:
 the workplane is essentially graph paper. 	 identify the various menus and inspectors of TinkerCAD.
 the snap grid view increases or decreases the scaling of the workplane. 	 identify how to edit the Snap Grid.
 TinkerCAD uses the metric system 	 distinguish between the x, y, and z axis.
 rotating and zooming will help you change the view of the workplane 	 distinguish between groups and nesting groups.
 the inspector window contains all of the objects, shapes, and tools to create a 3D shape. 	 distinguish between an regular and skewed object.
 the Boolean operation is combining two or more objects into one new object. 	 distinguish between rotation, scaling, and moving points on an object.
 the workplane and TinkerCAD can be easily manipulated using shortcuts, just like other 	

programs.

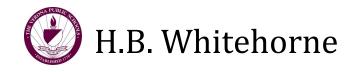
- the Home button zooms out/into the default view of the workplane.
- the x,y,z axis is controlled using the arrows on the menu (also other keyboard shortcuts).
- the Snap Grid is used to nudge an object a certain distance.
- the grouping of shapes can be undone.
- the grouping of objects is called nesting groups.
- the creating of an hole in an object is done by nesting objects.

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.

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 independently 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.

customize objects, create a stamp with a pattern of their own design and infany solve an open-ended chailenge problems.		
Students will understand that:	Essential Questions:	
 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 	 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:	Students will be able to:	

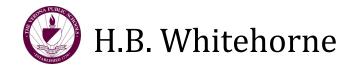
 the extrusion tool gives depth to a 2D shape. 	• Create objects using shape primitives, letters and imported STL files
 the planning and brainstorming process are crucial to a successful design 	Move, scale and rotate objects using handles
• a 3D printer prints an hollow object by default, but this can be changed in the printer density	Scale objects using the ruler
settings.	 Pan the camera in, out and around the model
 the proper handles to modify an object. 	 Group objects to make holes
 the align tool will align multiple objects along the x, y, and z axis. 	 Plan how to create simple objects
 the ruler allows precision along the workplane. 	 identify with the extrusion tool
 the extrusion tool to create objects of your own. 	 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:

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

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- 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
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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
- 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 independently 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:	Essential Questions:
 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. 	 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:	Students will be able to:
 CoSpaces has limitations and how to work around these limitations. How to use hotkeys Importing files is a great way to work around limitations 	 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.

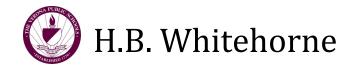
- the introduction of new tools that are not found in TinkerCAD
- how to navigate on a desktop and on a mobile device
- how the camera works and how it is crucial to setting up a scene
- Identify similar tools that exist in TinkerCAD and CoSpaces, e.g., snapping to a grid
- Make use of the hotkeys that 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

Established Goals:

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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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Transfer Goal:

Students will be able to $\underline{independently}$ 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:

• working with multiple programs to achieve results is commonplace.

- Audio, text, and 360 photos comprise a scene.
- designing individual parts is part of the whole process.
- Digital storytelling is much like traditional storytelling.

Essential Questions:

- What are some instances where an individual is part of a whole?
- How have you gone back to the drawing board before?
- How have you worked with multiple resources to achieve a final result?

Students will know:

- how to take their very own 360 photos using Google Street View
- how to import their own photos.
- that audio is a vital part of digital storytelling
- How to apply ambient sounds and scene narration

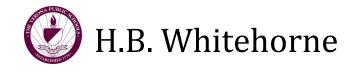
Students will be able to:

- Create 360 photos.
- Narrate their own audio using a variety of programs. .
- Distinguish between a POI (point of interest) and a scene overlay. .
- Comprise a scene that tells a story or has important information
- 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.



Unit 5: Final Project

Unit Duration: 10 days

Stage 1: Desired Results

Established Goals:

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- d. Transfer current knowledge to learning of new technologies

Transfer Goal:

Students will be able to independently 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. having a clear objective and goal makes the build process easier 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? How do you overcome obstacles in your way? What are some challenges you would face if working by yourself? What are some challenges you would face if working as a group?
Studente will know	Studente will be able to:

Students will know:

- how to stick to a strict timeline when creating their models.
- the planning and design process are essential and the most important.
- how to deal with failure.
- how periodical check-ins can help in the build process.

Students will be able to:

- envision their creation and then create it.
- identify ways to budget their time.
- identify which part(s) of their project will be most challenging.
- distinguish between being stuck and failure.
- 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).