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| **Title** | **Using Google Sketch Up to Design a Wing for a Glider** |
| **Introduction** | This lesson allows students design a wing for a standard glider and use Google Sketch Up to draw a 3D model of their glider. |
| **Curriculum Alignment** | 8108 Exploring Technology Systems Blueprint  004.02 Apply design and problem solving concepts and principles.  007.03 Design and fabricate a transportation vehicle.  008.02 Produce a communications product using one of the following: technical drawings, graphic communication, electronic communication.   |  |  | | --- | --- | | |  | | --- | | [**NT.K-12.6**](http://www.educationworld.com/standards/national/toc/index.shtml#numbers) **TECHNOLOGY PROBLEM- SOLVING AND DECISION-MAKING TOOLS** | |  * Students use technology resources for solving problems and making informed decisions. * Students employ technology in the development of strategies for solving problems in the real world.  |  |  | | --- | --- | | |  | | --- | | [**NT.K-12.3**](http://www.educationworld.com/standards/national/toc/index.shtml#numbers) **TECHNOLOGY PRODUCTIVITY TOOLS** | |  * Students use technology tools to enhance learning, increase productivity, and promote creativity. * Students use productivity tools to collaborate in constructing technology-enhanced models, prepare publications, and produce other creative works. |
| **Learning Outcomes** | Students will learn to read a basic part drawing and gain a basic understanding of how to draw using Google Sketch Up.  Students will use a multi-view part drawing of a basic glider and their design ideas for a wing to generate a Google Sketch Up 3D model. |
| **Time Required and Location** | This lesson should take approximately 180 minutes (Four 45 minute classes). |
| **Materials Needed** | Students will need their own computer with Google Sketch Up installed.  Google Sketch Up Command Game board sheet  Student Pencil and Paper  **Technology resources**  Students will need their own computer with Google Sketch Up installed.  The teacher should have the ability to project a teacher computer with Google Sketch Up to make it easier to show the class how to manipulate the program. |
| **Participant Prior Knowledge** | Students should be aware that they will continue to keep a project log. This can be paper and pencil or computer word processing file. Some work with paper and pencil will be required even if the project log is kept electronically.  Display a copy of the blueprint for the basic glider. Review terms from the previous lessons and ask students to tell you the size of the part based on the part drawing. Students need to identify fuselage, vertical tail wing, and horizontal tail wing. |
| **Facilitator Preparations** | Teacher should become familiar with how the simulation program works and should work through the lesson to find any potential issues that students may experience.Group the students in pairs so that they can help each other with making changes to the program and for the think-pair-share type activities. |
| **Activities** | Instruct students to start Google Sketch Up and hand out the Google Sketch Up Command Game board sheet. Introduce the game and tell students to check off the correct number of squares as that complete the required task. Explain to students that they will be asked to share their methods with the class to be checked off as the winner. (At the end you can make a frequency table of the student’s progress showing how many squares they were able to accomplish. They can anonymously see how they compare to their classmates and you can judge if the students are getting the concept based on how many and who was not able to obtain close to the average amount). Have the students who completed all of the tasks share their methods with the class for tasks that are a problem for some students.  Teacher should model for the class drawing the fuselage and horizontal tail wing. The teacher should check student work to ensure success. Students should work to complete drawing these two parts on their computer. Dimensions for the parts are to be taken from the basic glider part drawing. Teacher will view student work to ensure that the students are using proper tools and achieving the appropriate look for their glider drawing. Student drawings should look similar to blueprint (enough to be recognizable as the glider).  Teacher should model for the class how to use the push tool and placing the 3D fuselage and horizontal tail wing together. Have students complete these steps on their drawing and check to ensure correct.  **Guided Practice**  Students should be directed to close without saving and open the previous drawing. The teacher should allow students to finish drawing the basic glider (fuselage, vertical tail wing and horizontal tail wing) and combine into a 3D model using the push tool. The teacher should check to ensure student success. |
| **Assessment** | Students will draw their wing design using any available drawing tool, convert to 3D and combine with the basic glider to finish their 3D drawing. |
| **Critical Vocabulary** | Line tool – tool used to draw straight lines  Arc tool – tool used to draw curved lines by clicking on three points  Rectangle tool – tool used to draw a rectangle by clicking on two points  Circle tool – tool used to draw a circle by clicking on the center point and dragging to indicate radius  Protractor Tool – tool used to measure angle to draw next line  Push / Pull Tool – tool used to transform a 2-D object in to a 3-D object |
| **Modifications** | For students that have difficulty reading or taking notes pre-prepared notes can be made available.  Students can be paired so that at least one of the students is capable of reading instruct sheet.  Students can be aided by allowing them to open one of the teacher created drawing files to help them progress without repetition of difficult tasks or to realign if the 3D view causes difficulties. |
| **Alternative Assessments** | Arrangement can be made for students with special needs to have the directions read to them. |
| **References** | Examples of student work created with Google Sketch Up:  Google Sketchup drawings - <http://picasaweb.google.com/gallery.sketchup/EducationK12#slideshow/5340615027918562050>  Teacher Use Google Sketch-up Related sites:  Google sketch up tutorial - <http://sitescontent.google.com/google-sketchup-for-educators/Home/tutorials-and-tips> Additional Google Sketchup lesson ideas – [PDF lesson idea](http://7348974248286267995-a-1802744773732722657-s-sites.googlegroups.com/site/gtaresources/files/Crib_SketchUp.pdf?attachauth=ANoY7crDwtf7Se7i588mNefc_Qey2JN-joUbj7rtO6NDGYN7DdwlFGiurc3TKEd7mvwi5NOozHBLl9G9v38WzKfyo8XLW4w9AnZY6nPc5noCfMBKg7ToJT1FH-EH2EpItxHKJOwLJntBHfZz3LRUH_LNoLQ5bFzWqp_KoNGq_gjnohomLg9joJwbk5EalGgYjU1M8k6dIrAOpfo248nbRtwdm1Ox0RAaKQ%3D%3D&attredirects=0) |
| **Supplemental Information** | Please view the Google Sketch Up tutorial to gain assistance with using the program. |
| **Author Info** | Teacher  Russell Sparks  East Wilkes Middle School, Wilkes County Schools  Exploring Technology Grades 6th – 8th  Curriculum  Exploring Technology is an entry level CTE course giving an overview of various areas of technology and careers associated with these areas. The externship involved work in the applied engineering school of Wilkes Community College and local aerospace industries. I was introduced to the tools and concepts used to prepare students for careers in the aerospace industry and given an opportunity to see the industry processes. This will allow me to give my students a better understanding of the steps needed to prepare themselves for the future.  Mentor  Lyndell Duvall  Wilkes Community College  Chair Applied Engineering Technologies, Industrial and Engineering Technology |