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| **Title**  | Lift Off |
| **Introduction**  | This lesson allows students to launch their glider to collect data on flight distance. Students will create a spreadsheet to document each class member’s result and calculate statistical information. Students graph the results to identify trends. |
| **Curriculum Alignment**  | Math Common CoreThe Number System 7.NSApply and extend previous understandings of operations withfractions to add, subtract, multiply, and divide rational numbers.3. Solve real-world and mathematical problems involving the four operations with rational numbers.1 8108 Exploring Technology Systems Blueprint005.02 Use computers and other tools of technology in various applications.Computer / Technology Skills – Competency Goal 3: The learner will use a variety of technologies to access, analyze, interpret, synthesize, apply, and communicate information. 3.05 Modify/create spreadsheets and graphs/charts to analyze and interpret data for content assignments. (3)  |
| **Learning Outcomes**  | Students will gain an understanding of how to define important characteristics for testing and how to collect and analyze data trends.Students will observe each class member’s glider and define characteristics that may benefit the gliders flight. Students will gather data on glider weight, wing shape and size and flight distance. Students will calculate wing area and wing loading. Students will input data into a spreadsheet and generate statistical data, graphs and a written analysis of the information and trends observed. |
| **Time Required and Location**  | This lesson should take approximately 135 minutes. A breaking point is indicated below for breaking the lesson into three 45 minute class periods. |
| **Materials Needed**  | Student Pencil and PaperSidewalk chalk, tape or spray paint see note under teacher prepMeasuring tape (at least 25 ft)Digital Scale**Technology resources**Each student should have a computer with word processing software. Students can complete this activity with paper and pencil if computer with WP software is not available.Each student will need access to a computer with a spreadsheet program.Teacher should be able to project the use of the spreadsheet program for demonstrating. |
| **Safety**  | Follow typical classroom safety procedures.Be careful with blades and the hot glue. |
| **Participant Prior Knowledge**  | Teachers should make sure that students are familiar with using a digital scale to determine the weight of an object. Students will need to be able to weigh their planes to use the weight and area to calculate wing loading.Students should be aware that they will continue keeping 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.Students should record the following data for their plane on a note card and be prepare to share with the class during the activity. Weight, Span, Chord, wing area, and wing type (round, flat). |
| **Facilitator Preparations**  | The teacher will need to setup the launch area including launch pad, marking off flight area and distances. Be prepared to measure and mark additional distances if gliders perform better than expected.Use sidewalk chalk to mark flight area if on parking area or concrete. Use tape if indoors. If in grass area you can use spray paint but remember that it will stay there a long time unless the grass is cut.  |
| **Activities**  | Gliders should be placed on display around the room. Students should be directed to rotate around the room to each glider and create a system to categorize each glider into groups.The teacher will lead a discussion asking students what characteristics they saw that might give a glider chance of being successful. Lead students to discuss this in terms of the categories they created. (Students might categorize by wing shape, construction method, or material, etc. Discuss how light materials could cause lower wing loading, wing shape might increase lift due to camber, angle, area.)Have students place the information cards by their glider then rotate to each glider and record owner name, plane weight, wing span, wing chord, wing type (round, flat). Students should also record the class of the plane based on the categories defined earlier. Students should enter this data into a spreadsheet directly or record on paper to be entered later. (End first 45 minute class)Students will launch their gliders and record the distance for glider on their spreadsheet or paper. After getting the launch data ensure that students have a spreadsheet listing the builder’s name, plane weight, wing span, wing chord, wing area and foil type (round or flat), class and distance traveled. (Modeling the setup of the columns and titles for the students can be helpful. See below)

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| Name | Plane Weight | Wing Span | Wing Chord | Wing Type | Class | Wing Loading | Distance Traveled |

(End second 45 minute class)**Guided Practice** Students must develop correct formulas for calculating the wing loading and maximum, minimum and mean of the flight distance data. (wing loading = weight of plane / wing area, use the =max(cell range), =min(cell range) and =average(cell range) functions to calculate maximum, minimum and mean flight distance.)Students should be directed to graph the flight distance data and look for trends to see which characteristics led to the best flights. Recommend to students that they also sort the data by class, wing area, wing loading, etc. and look for trends to indicate characteristics that led to longer flight distances.Discuss ideas with individuals as they find a trend and then allow that individual to share their thoughts and data with the class. Discuss as a group why this characteristic might be a good idea. |
| **Assessment**  | Students should document ways that they would change their glider to possibly get longer flight distances. Students must back up their decisions with data from their spreadsheet and graphs. Record this information on a sheet to turn into the teacher. (Look for students to say that the planes with lower wing loading flew best, or trapezoid wings flew best, etc. and to site examples from the spreadsheet such as John’s plane that was a trapezoid flew 10 feet). |
| **Critical Vocabulary**  | Trend - a pattern in the data you are studyingMean – the average of a set of numbers. (Sum the items and divide by the number of items)Maximum – the largest number in the setMinimum – the smallest number in the set |
| **Modifications**  | For students that have difficulty reading or taking notes pre-prepared notes can be made available.Save a completed spreadsheet under a special file name and allowing students who work slowly to use to ensure they have the proper data.Students can be paired so that at least one of the students is capable of reading instruct sheet.  |
| **Alternative Assessments**  | Arrangement can be made for students with special needs to have the directions read to them and to answer the questions orally. |
| **Author Info**  | TeacherRussell SparksEast Wilkes Middle School, Wilkes County SchoolsExploring Technology Grades 6th – 8th CurriculumExploring 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.MentorLyndell DuvallWilkes Community CollegeChair Applied Engineering Technologies, Industrial and Engineering Technology |