Show Me the Money

This lesson is an application activity in which students will use relative frequencies to support an argument. Students will be given the task of creating an argument that would support why their club/team should be awarded a monetary prize that the school has won. The students will create statistical questions, collect their own data, analyze and interpret it to support their claim, present their argument, critique other arguments, and refine their argument for a rebuttal and closing remarks. The project will be graded with the rubric found in the Summative Assessment section, and has a student packet attached as well. All attachments can be modified.

Subject(s): Mathematics
Grade Level(s): 9
Intended Audience: Educators

Instructional Time: 3 Hour(s) 5 Minute(s)

Resource supports reading in content area: Yes

Keywords: Frequency, Joint Frequency, Two-Way Frequency table, Relative Frequency, Marginal Frequency, Conditional Frequency, Data Collection

Instructional Component Type(s): Lesson Plan, Problem-Solving Task, Project

Resource Collection: FCR-STEMLearn Algebra

ATTACHMENTS
Show_Me_the_Money_Rubric.xlsx
Show_Me_the_Money_Student_Packet.docx

LESSON CONTENT

Lesson Plan Template: General Lesson Plan

Formative Assessment
- Prior to collecting the data, students will submit the questions they will be asking to collect their data.
- Students will turn in the data/statistics they are using before writing the essay and creating the presentation.

Feedback to Students
- The teacher will determine if the questions are statistical questions and provide support as necessary so that all of the students will identify and create statistical questions that will be used to collect data that will support their argument.
- The teacher will check for errors in the data and assist students if necessary.

Summative Assessment
- Students will create and present an argument in an effort to win a monetary award for their team/club. The argument will be supported by data, in which students will calculate and interpret different relative frequencies in order to provide evidence of their claim.
- Students will also critique the arguments of other teams/club, providing written and verbal rebuttals.
- Students will submit an essay that presents their case, a PowerPoint or Prezi that will be used during the presentation, and a written critique of three of the other teams/club's arguments.
- Students will also present their argument, as well as their critiques of the other groups. The essay, PowerPoint/Prezi, critique, and presentations will be graded using the attached rubric.

Show_Me_the_Money_Rubric.xlsx
Learning Objectives: What will students know and be able to do as a result of this lesson?

Students will be able to:
- Collect and represent bivariate data using two-way frequency tables.
- Calculate and interpret relative frequencies (joint, marginal, and conditional) in the context of the collected data.
- Construct an argument based on the relationship(s) that may or may not exist between the two variables represented by the data.
- Present an argument and evaluate the arguments of others by using qualitative/quantitative data to support their ideas.

Guiding Questions: What are the guiding questions for this lesson?
- How can relative frequencies be used to support an argument?
- What type of data can help me prove that my team/club deserves a monetary prize?

Prior Knowledge: What prior knowledge should students have for this lesson?

Prior to the lesson, students should be able to:
- Know what good statistical questions are that elicit statistical data.
- Collect and organize data.
- Display bivariate data on a frequency table.
- Convert data to percents.
- Calculate relative frequencies (joint, marginal, and conditional).
- Write a formal essay.

Identification of the Task: How will the teacher introduce the major topic to be studied and capture students' interest?
- The teacher will announce that the school was awarded a prize of $2,000 to be given to a team/club of the principal's choice. The principal has decided to give students the opportunity to present an argument to him as to why their team/club should win the award.
- In the argument, however, students must support their claims using data that is presented using frequency tables and measures of relative frequency. The teacher will explain that the students must collect, analyze, and interpret data in order to form their argument.
- All of the students will present their argument and will be critiqued by their peers. They will have a chance to give a rebuttal along with closing remarks.
- All clubs/teams are eligible for this contest, including athletic teams, fine arts, special interest groups, community service, and classes (example: Class of 2018).
- Students who are not a member of a team or club will argue in support of their class.

Time Breakdown:
- Day 1 in Class: Present project, review student packet, students complete Part 1 and Part 2 and teacher approves. (20 minutes)
- Outside of Class: Students collect data and complete Part 3 (amount of days given for this can vary; should be about 3-5 days in order for the students to collect sufficient amount of data).
- Day 2 in Class: Students turn in Part 3, teacher reviews finding relative frequencies if necessary, reviews the rubric and what is expected for the essay and visual presentation, students begin working on Part 4 and Part 5. (30 minutes)
- Outside of Class: Students complete Part 4 and Part 5 (amount of days given for this can vary as well, anywhere from 2-4 days depending on how much work got done during the class session).
- Day 3 in Class: Students present arguments and critique each others' arguments; writing their critiques on three different notecards for the three different groups. (45 minutes)
- Day 4 in Class: Roundtable discussion- see Argumentation Session, students complete Part 6 (45 minutes)
- Outside of Class: Students complete rebuttal/closing remarks (Part 7).
- Day 5 in Class: Students present rebuttal/closing remarks, vote for which club/team should win the prize, have reflective discussion and complete exit slip. (45 minutes)

Data Generation: How will students collect and/or use data, tools, models, and/or theories?
- The students will first generate statistical questions that can be asked in order to provide the necessary data to support their argument. The teacher will approve the questions and provide feedback if necessary to ensure that all students have valid statistical questions that can provide reliable bivariate data to support their claim.
- The students will then collect the data by surveying members of their club and non-members (outside of class time) and use frequency tables to organize the data.
- Students should know who is a member of their club/team, and will be given a list of the team coaches/club sponsors, who they can reach with any questions.

Production of a Tentative Argument: How will the students generate an argument that can be easily communicated by others?
- The students will refer to the data, and include the tables as figures, within their argument essay, as well as the visual presentation accompanying their oral presentation.
- The data should support the students' claim that their team/club should receive the monetary prize. This could be based on academic achievement, the number of accumulated service hours, the amount of involvement in fundraisers, etc., by the students in the team/club.
- The students will use the data to write an essay as well as create a presentation that is composed of an oral presentation accompanied by a PowerPoint or Prezi.
- The data that is presented should be easy to understand and the main points of the argument should be directly based on the data.

Argumentation Session: How will the students propose, support, evaluate, and refine each other's ideas?
- The students will present their argument to the class using the PowerPoint/Prezi as a visual aide (this should take an entire class).
- After all of the students present their arguments, each student will critique at least three of the presentations, pointing out flaws in the data or miscalculations, as well as misleading information that the data provides.
- These critiques will be written and presented to the class in a roundtable discussion, in which the students will have an opportunity later to form and present a rebuttal along with closing remarks.
- For a roundtable discussion, the teacher may follow the following format:
  - Teacher says which group is being discussed, and picks a student who wants to share their critique first.
  - When a student shares, he/she must first say something they liked/agreed with in the presentation, then give his/her comments about the argument.
  - Teacher asks if any other student has anything to add to that comment.
  - Students may add their comments, also first stating what they like/agreed with then providing their feedback.
  - Discussion should progress from one presentation to another, and the teacher may help move this along by stating when the discussion is moving on from one presentation to another.

Written Report: What guidance will students be provided with when developing a report of the investigation?
**Related Standards**

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| **LAFS.1112.WHST.1.1:** | Write arguments focused on discipline-specific content.  
  a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.  
  b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.  
  c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.  
  d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.  
  e. Provide a concluding statement or section that follows from or supports the argument presented. |
<p>| <strong>Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.</strong> | a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and |</p>
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| **LAFS.1112.WHST.1.2:** | Multimedia when useful to aiding comprehension.  
  b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.  
  c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.  
  d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.  
  e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic). |
| **LAFS.910.L.1.1:** | Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.  
  a. Use parallel structure.  
  b. Use various types of phrases (noun, verb, adjectival, adverbial, participial, prepositional, absolute) and clauses (independent, dependent; noun, relative, adverbial) to convey specific meanings and add variety and interest to writing or presentations. |
| **LAFS.910.RH.3.7:** | Integrate quantitative or technical analysis (e.g., charts, research data) with qualitative analysis in print or digital text. |
| **MAFS.912.S-ID.2.5:** | Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. ★ |