Beverage factory

Summary

Age category
9 - 12 years
Topic
Data & Statistics
Measurement
Numbers & operations
Total duration
190 minutes

Students do a survey on healthy beverages. They think of different recipes and produce a favorite beverage. They sell the beverages for example during lunch break, at a school party, ...

Problems to be tackled:

Producing self-made beverages that can be sold? That's quite a challenge! Different problems occur that are STEM-related. Children have to find solutions for these problems. As a consequence, mathematical concepts have to be applied.

Some examples of problems and the link to STEM:

What kind of beverage will people want to buy?

- We need to produce beverages that are tasteful and attractive. This means that we have to think of criteria, such as colour, taste, smell, healthiness, viscosity, ..., and test our beverages. *(Science)*
- We need to be sure that our beverages are liked by a majority of people, so we'll have to collect data based on the selected criteria for different people, and optimize our beverage using the test results. *(Science – Mathematics – Engineering) [data & statistics]*

How will we produce our beverage, and how can we produce large quantities?

- We need to think of resources, instruments, materials, ... and how we can use them appropriately. *(Technology)*
- We need to create a recipe, as our beverage needs to be reproducible. This means we have to measure the amounts we use and apply proportions. *(Technology – Mathematics) [measurement]*
- We need to think of time efficiency, as we have to produce large quantities. *(Engineering - Mathematics) [measurement]*

How can we earn money for charity based on the production of our beverage?

- We need to have a clear overview of the production costs. *(Mathematics) [Numbers & operations]*
- We need to make profit, therefore we have to compare the production costs with the selling price. *(Mathematics) [Numbers & operations]*

Real context

Real world motivation

Within a while there will be a school party, market, ... where self-made beverages will be sold for a charity purpose.

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Also other motivational contexts are possible, for example: Soft drinks have recently been banned at school or we want to have a sugar smart school. However, many children would like to drink a delightful and healthy drink during the afternoon break. The oldest children of the school get the opportunity to open a little shop at the playground.

Goals

Skills

Domain-general:

- Asking questions and problem solving (e.g. how can we reproduce our favourite drink for a large group of people?)
- Planning (e.g. planning the production of a self-made beverage with the use of certain ingredients)
- Collecting, analysing and interpreting data (e.g. finding a way to obtain objective information about selecting the best beverage)
- Reporting data (e.g. explaining which influence different proportions of ingredients have on the taste of the beverage)
- Reflecting (e.g. which steps did we follow to produce the best possible drink?)
- Entrepreneurship (e.g. comparing price for production with selling price)

Mathematics:

- Measuring amounts of liquid by using different measurement instruments and measurement scales.
- Working on proportions (e.g. the amount of sugar in a beverage).
- Making calculations and explaining them, using the right terminology, in concrete situations.
- Sorting things based on a qualitative comparison of one or two criteria.
- Experiencing and inquiring the relations between certain units such as profit and loss.

Science:

- Finding out strategies to compare items in a qualitative way.
- Comparing different items based on qualitative criteria and controlling variables to find out the answer to a certain research question (e.g. finding out in an objective way which drink is the most popular).
- Explaining comparisons concerning colour, smell, ... with the correct terminology by using the senses.

Technology - Engineering:

- Choosing the right measuring tool to measure different quantities of liquid.
- Experiencing that the efficiency of the measurement is influenced by the measurement unit, the goal of the measurement, the procedure and the skills of those who measure, the quality of the measurement tool, the type of materials that need to be measured and the rounding of the measurement.
- Experiencing that certain products are made conform certain technical principles and determinig what the function is of each separate ingredient.
- Determining which criteria a certain product needs to have.
- Using materials, tools and ingredients in order to produce a certain product in a correct way.
- Thinking critically towards a self-made preparation.
- Optimizing a self-made preparation/product by reflecting upon the criteria and production process.

Knowledge

Mathematics:

- Measurement of amounts of liquid. Measurement tools and scales.

- Proportions.
- Statistics. Tables, charts and diagrams.
- Qualitative comparison.
- Calculations. Price. Profit.

Science:

- Senses. Taste. Flavour.
- Health in relation to food.

Technology - Engineering:

- Products and ingredients.

Methodology

Part	Description	Timing
1	**Introduction: group work - class discussion** The teacher discusses the context with the students. The students are stimulated to make a really tasty and healthy drink. In small groups (3-4) they determine which are the criteria for a really tasty drink (e.g. tastes good, healthy, colourful, smells good, not too thick, ...). These criteria need to be measurable (see further). The whole class group needs to agree on 4-5 criteria to judge the drinks. Or a survey can be done at the school to get criteria.	20'
2	**Making your own drinks: group work** The students get 20 minutes to produce at least 2 different drinks with the given ingredients and instruments (see materials). They need to agree on the amount of each drink (e.g. 10cl). Note! Make children aware of the resources and instruments that are provided, and the need to work economically (price!) and to take into account the reproducibility of the drinks (stimulate them to make a recipe).	25'
3	**Testing the self-made drinks: class discussion** The students discuss how they can know if their drinks are successful (e.g. an impartial jury can be brought together in order to evaluate the drinks based on the measurable criteria). They discuss how they can collect the test results and how they can compare them. They need to agree on a judgement strategy. In the end each group keeps one drink which is the favourite one of the jury.	45'

4	**Optimizing the favourite drink: group work** The students optimize the favourite drink based on the feedback (criteria) of the jury. They think of a name for their drink.	30'
5	**Producing on a large scale: group work** The students are challeged to produce their drink so that the whole class can have a taste. Highlight on: • The amount: how much do we exactly need to produce? • Reproducibility: recipe with quantities, proportions, ...? • Efficiency: produce as fast as possible (students only get 30 minutes) • Economically: keep the price as low as possible (don't spoil ingredients) – price for one drink?	30'
6	**Throwing a party: class event** The students taste the different drinks and discuss based on the criteria.	20'
7	**Reflection: class discussion** The students reflect on their experiences: How have they produced enough beverages? What went wrong/well during production process, ...? How could they work faster/more economically/...? The students think on how they can produce their drink for the whole school, for all the people who will come to the school party, market, ... They calculate the amount of ingredients, prices, efficiency, ...	20'

Organization

Materials

- Glasses, bottles, measuring cups, spoons, ...
- Cranberry/grape/passionfruit/... juice
- Sparkling and still water
- Oranges, citrons, ...
- Fruit press, knifes, boards, funnels, ...
- Sugar, syrup, honey, ...
- (extra ingredients can be added)

Grouping

- Groups consist of three students.
- Attitudes needed in a group:
  - Creativity
  - Accuracy

Printables

- Worksheet Beverage factory

Coaching

Useful questions

- What do you think that people find important to buy a beverage? (What do you think is typical for a delightful beverage?)
  in order to prevent children from starting without thinking

- How can you produce different beverages that meet the defined criteria, by using the resources, instruments, materials that are provided?
  in order to stimulate children to think of making different proportions of ingredients, and to see which effect this has on taste, smell, ...

- How can we know which beverage will sell the best? (How can we know which beverage is the favourite one? How can we test this?)
  in order to let children think about a judgement strategy, including objective judgement conform their criteria (e.g. comparing the amount of sugar in each beverage), control of variables (testing one criteria at a time) and an convenient overview of the test results (table, calculating scores, ...)

- How can we be even more sure that we will sell our beverages easily? (How can we optimize our selected beverages?)
  in order to stimulate the children to think of ways to produce an even better beverage, but based on the test results

- How can you produce enough of your favourite beverage, so that each child of (half/one third/... of) the class can taste?
  in order to let children calculate the amount of beverages and the amount of ingredients needed, so that they can obtain exactly the same beverage for each test person

- How can we produce the beverage as fast as possible? (How can we optimize our production process?)
  in order to let children think of their production process with regard to task division, time management, use of instruments (e.g. mould), ...

- What do you think we will earn by selling our beverages?
  in order to let children calculate production costs, profit, ...

- General reflection questions, such as: What did you do? What went well/wrong? Why? What would you do differently next time? ...

Adaptations

- Think about allergies... Some children can have an allergy to some fruits.
- Class is divided in small groups (3 or 4 children in each group).
- During the activity a lot of thinking needs to be done before children can start working in group, e.g. to produce different beverages, to produce enough of one beverage for the class group, ... As a result, the teacher can have more or less control over the activity.
- When children need to make their first drinks in order to taste, you have to agree on the amount of each drink (e.g. 20cl). For younger children it can be easier for them to make a taster of 10 cl, which is easier to calculate and go to 1l. 50 ml/5cl can be used for older children.
- For older children you can differentiate by using fractions (e.g. 1/3) instead of measurements.
- Some children need help, e.g. in their way of working: e.g. First think what you need for your recipe, don't take

everything immediately..

- The activity can also take place in a more open way: children can start producing their own favourite drink immediately and then encounter a lot of problems that they need to correct along the way during the activity.
- Depending on the age-group, the mathematical concepts can vary in difficulty, e.g. more of less difficult proportions (half, one third, ...), the overview for the test results can be given or created by the children themselves, use of more or less detailed measure instruments, ...

Assessment

Teacher's assessment:

Assessing will take place in a formative way, especially regarding:

- Problem solving *(e.g. thinking about how we can reproduce our favourite beverage for a large group of people? ...)*
- Planning *(e.g. planning the judgement/test strategy to obtain a favourite drink for each group ...)*
- Collecting, analysing and interpreting data *(e.g. explaining which influence different proportions of ingredients have on the taste ...)*
- Reflecting *(e.g. rethinking of the process to produce beverages as quickly as possible ...)*

Student's assessment:

- Group work
- Individual contribution to the work
- All the task completed on time
- Biggest difficulties
- Ways to overcome the difficulties