

## Modul: Fractions – Maths and Music

Subjects: Maths and Music

Age of students: 10-13; 25 students

Objectives – what the students are supposed to know or to be able to do:

At the end of the module students:

- Have acquired a greater general understanding of fractions through learning in a practical approach (part of the whole, addition, subtraction of fractions, recognizing analogies of bars in music, etc.)
- Are able to link knowledge of mathematics and music (fractions, bar, note value, pause etc.)
- Are able to discover, explore, describe and explain mathematical phenomena in everyday situations, e.g. in music
- Appreciate the satisfaction of mutual music rhythm creation

Opportunities – Other things students might also learn although it's not the main goal

At the end of the module students:

- will be able to cooperate and share ideas
- express themselves better and be conscious of connections between school subjects and topics

Arts involved: music

Ressources - apples, stones

Time frame – 3 lessons

Methods of work - different methods of work were employed: individual, pair-work, group –work, panel discussions

Procedure / steps:

### First Lesson – Fractions in Music



- Division of 6 apples (a whole, half, quarter... 32nd)

- Putting these parts of the whole in relation to note and pause values
- Language of music: emphasis on certain note values in musical bars – where is the stress in the following bars? (e.g. four-stroke bar: emphasis on 1 and 3)
- Intonation of poem „Bumerang“ by Joachim Ringelnatz. Students recognize stress on certain syllables and convey this in rhythm notation

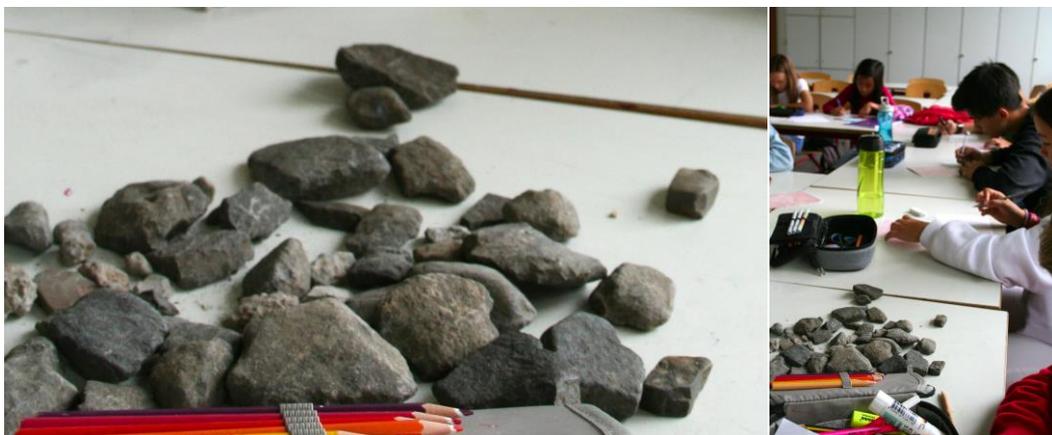
**Poem: Bumerang von Joachim Ringelnatz**

War einmal ein Bumerang;  
 War ein wenig zu lang.  
 Bumerang flog ein Stück,  
 Aber kam nicht mehr zurück.  
 Publikum — noch stundenlang —  
 Wartete auf Bumerang.

**War** einmal ein **Bumerang** / **War** nur leider **viel** zu lang / ...



- „treasure hunt“ with the help of a map: three rhythm patterns (a quarter note, two eighth notes, two eighth note and one triplet= three eighth notes are played at the same time as two eighth notes). The rhythm patterns are presented and stand for directions (up, left, down, right): students listen to rhythm patterns in certain order and find treasure on map
- Students create their own rhythm path by choosing individual order of rhythm patterns and present results to partner (more directions are introduced (half note, four quarter notes, whole note))





- The stones that the students have collected and brought to the lesson are sorted in different sizes, are then matched with different note values and labelled accordingly (smallest stones = smallest note value: one sixteenth...)

## Second Lesson: Fractions in Mathematics

### 1. Introduction

What is the current topic of the Erasmus module?

What did you work on in the last lesson?

How are musical notes connected to fractions in mathematics?

### 2. What is a fraction? Factual connection and mathematization

- example: sharing 3 pizzas with 4 children, what is the best way of doing this? How many slices for each child?

→  $\frac{3}{4}$  is the share of every child, this is what you call a fraction. A fraction describes the part of a whole that was divided into equal parts/amounts (Definition).

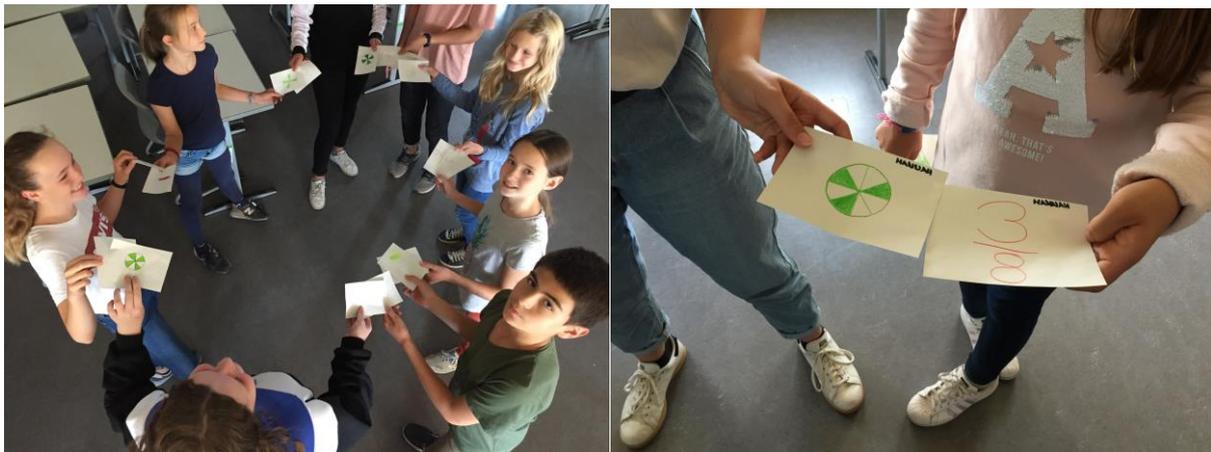
$\frac{3}{4}$  ← Zähler  
 ← Bruchstrich  
 4 ← Nenner (numerator, fraction line, denominator)

Pronunciation: „three quarters/ three fourths“

### 3. Visualization of fractions (connection to art)

- colouring-in of fractions on paper and writing of mathematical fractions on another paper: two-way visualization of fractions
- How do you pronounce fractions in English?
- together with a partner, students pronounce fractions in English, later with the whole group

### 4. Game: Fraction Dominoes



- more visualizations of fractions: create two different cards: use the colour green for the picture of a fraction and the colour red for a fraction in numbers, partner corrects
- teacher collects red and green cards, shuffles them separately and hands out: green cards in left hand, red cards in right hand.
- task: every left hand must find a matching right hand.

Preparation: speculation: which geometrical figure will develop when you match hands/cards? → various circles

Check if you have matching cards and ask teacher to exchange them if you do.

→ No talking during the game!!!

*Possible continuation:*

### **fractions as musical notes, addition and subtraction of fractions**

ganze Note	$\circ = \text{♩} + \text{♩}$
halbe Note	$\text{♩} = \text{♩} + \text{♩}$
Viertelnote	$\text{♩} = \text{♩} + \text{♩} = \text{♩♩}$
Achtelnote	$\text{♩} = \text{♩} + \text{♩} = \text{♩♩}$
Sechzehntelnote	$\text{♩}$

1 Gib die Notenwerte an und stelle fest, ob es sich um einen 2/4-, 4/4- oder 3/4-Takt handelt.

a)

b)

c)

2 Schreibe die Brüche als Noten und gib an, ob es sich um einen 2/4-, 4/4- oder einen 3/4-Takt handelt.

a)  $\frac{1}{4} + \frac{1}{4}$                       b)  $\frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8}$

c)  $\frac{1}{4} + \frac{1}{4} + \frac{1}{4}$                 d)  $\frac{1}{8} + \frac{1}{2} + \frac{1}{8}$

e)  $\frac{1}{4} + \frac{1}{4} + \frac{1}{2}$                   f)  $\frac{1}{4} + \frac{1}{8} + \frac{1}{8} + \frac{1}{2}$

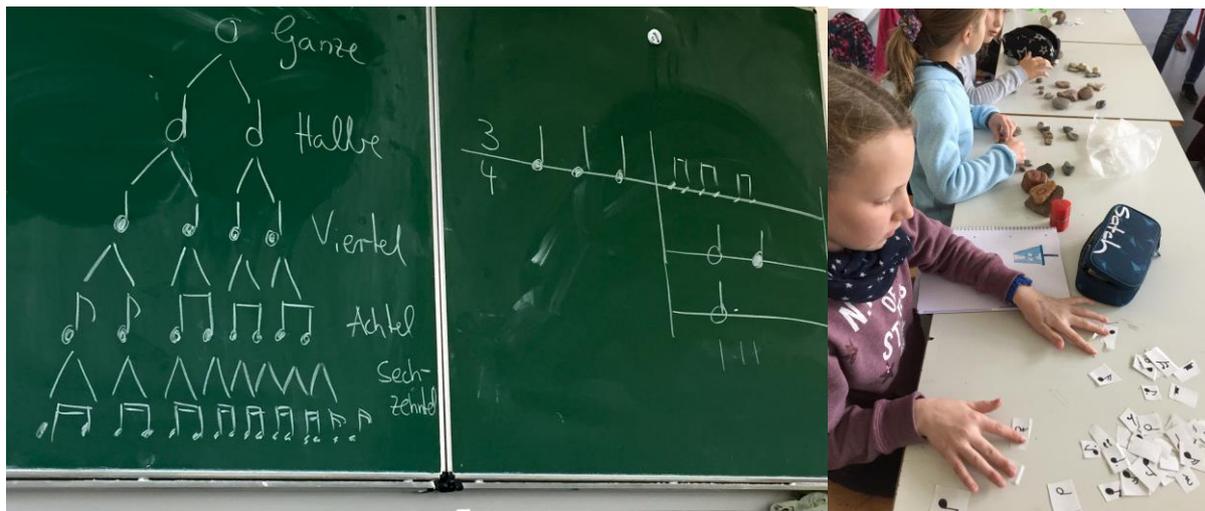
### Third Lesson: Fractions in Music



- labelled stones are used to create different bars (note and pause values) which are then transferred acoustically into music: students walk the bars, hit stones on the table, etc.
- students experiment with various bars (3/4-bar, 5/8-bar, 2/2-bar...) and calculate different values...
- rhythm patterns are implemented (Mozart: „Entführung aus dem Serail“: “The Abduction from the Seraglio”): Students listen and detect rhythm patterns and note values



- students use stones to compose their own piece of music (rhythm) for several voices and play it polyphonically



- closure: Singing off the song „Der Rhythmus und der Nenner“ („the rhythm and the denominator“)

### General evaluation:

The biggest challenge of this module was the heterogeneity of our students. We now have three different age groups: class 5, 6 and 7. With the help of the introductory evaluation we realized that the students from class 5 had never even heard of fractions, those from class 6 knew the basics and class 7 were already working with fractions in various and complex contexts. So it was difficult to introduce the topic in a way that did not go over the head of some of the younger students and at the same time wasn't too boring for the older ones. On the whole, the module stayed on the basic level. Through the interdisciplinary approach, however, all students found a way to get (re-)connected, add personal input and learn something from the module (cf. final evaluation: many students stated they hadn't been aware of the parallels in music and maths and thought they could now make use of them in more complex mathematical contexts. Some also said the module had helped them to understand different note and break values in music).

Another difficulty was the fact that due to timetable problems the respective music and maths teacher could never actually be there at the same time. We had a thorough planning session and then we alternated lessons, so that the students understood the interconnection of the subjects. However, it would have been even better if both colleagues could have engaged in a team-teaching approach. This way both could have benefited even more from each other, the methodology and the context of the different subjects.