



# European Music Portfolio (EMP) – Maths: *Sounding Ways Into Mathematics*



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Introduction to the project: Aims, strands and outcomes

Professor Graham Welch, UCL Institute of Education

The challenge?

How to prepare children and adolescents for the information and knowledge society where mathematical skills and the capacity to apply them in different contexts outside of mathematics are a key competence of every educated individual?

The approach?

Innovative and creative approaches are indispensable in making the learning of mathematics more active, inquiry-based and interesting for all pupils, including the differently abled.

However, teachers are not well prepared for this type of teaching. Teacher education often follows the structure of school curricula in the sense that it is discipline based. Such approaches are poorly matched to our inherent brain design.



Aims?

To celebrate the distinctive and shared features of mathematics and music to nurture development and understanding in each.

To increase motivation and engagement of children (and their teachers and, by implication, carers) in engaging with mathematics and music.





## EMP-Maths: Sounding Ways Into Mathematics Symposium Format

- Introduction to project: Aims, strands and outcomes
- Presenting the practical activities (audience participation required)
- Each of the partner organisations represented today will address the following questions: Where are we now and where are we going? Why is the EMP-M project important and what are the benefits? What are the challenges of working with the EMP-M project?
  - Colleagues from Barcelona
  - Colleagues from Switzerland
  - Colleagues from England
  - Colleagues from Romania
- Additional practical activities (audience participation required)
- Questions, comments and responses
- Concluding remarks



# Practical activity 1



## Does music strike a chord in maths in Catalan and Spanish schools?

Laia Viladot, Albert Casals,  
Carmen Carrillo & Montserrat Prat



## Where are we now and where are we going?

	Maths	Music
Politics	Increase of hours	Scant attention
School	Disaffection of a number of students and teachers	Useful tool to engage students
External agents	Low results in official evaluations	Recent research supports Music for childrens' learning



## Where are we now and where are we going?

	Integration of Music and Maths at school	
Strengths	Educational (and social) interests	Modest but increasing school practices
Constraints	Limited research	Lack of materials

## Why is the EMP-M project important and what are the benefits?

Because the project...

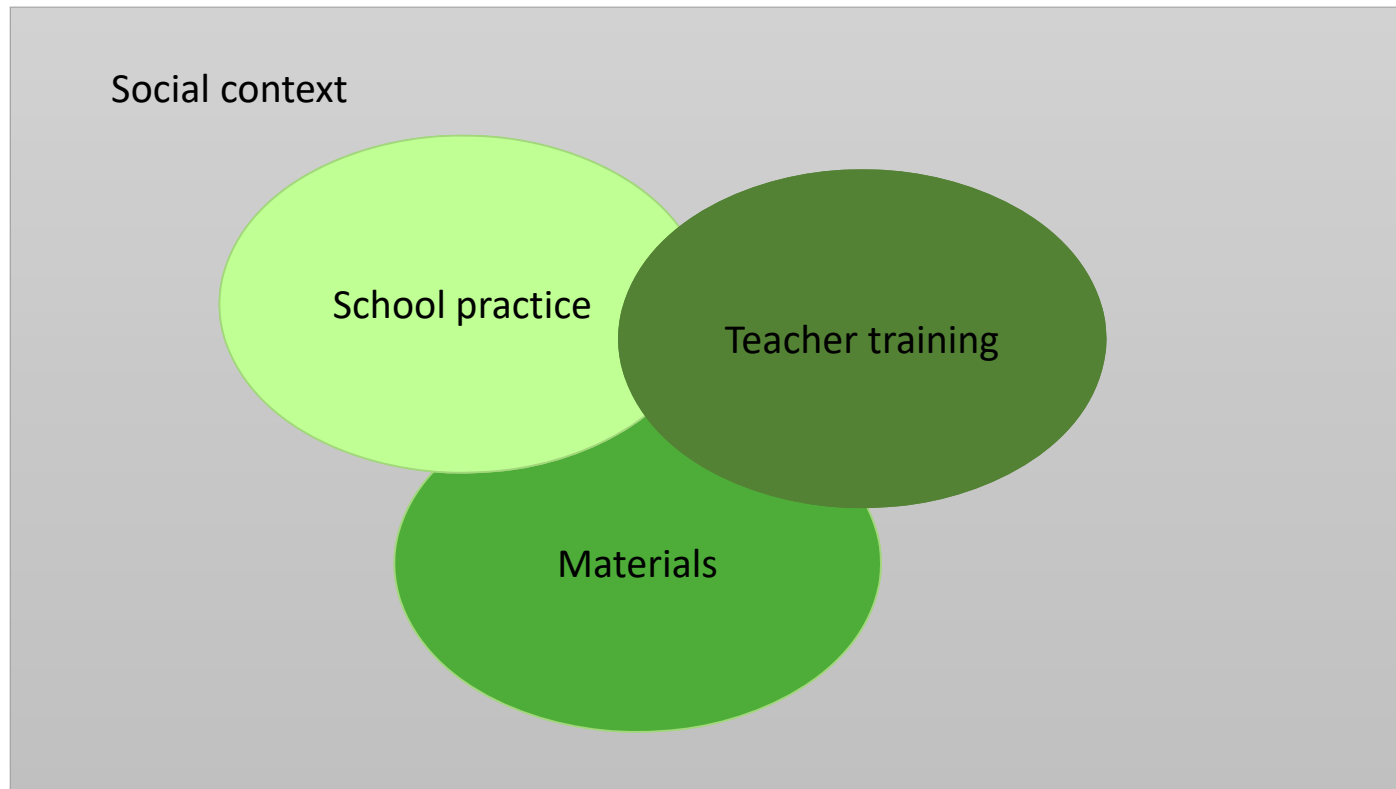
- ... connects with current pedagogical renewals movements
- ... impacts on the existing needs of the government's educational agenda

The (expected) benefits are related to...

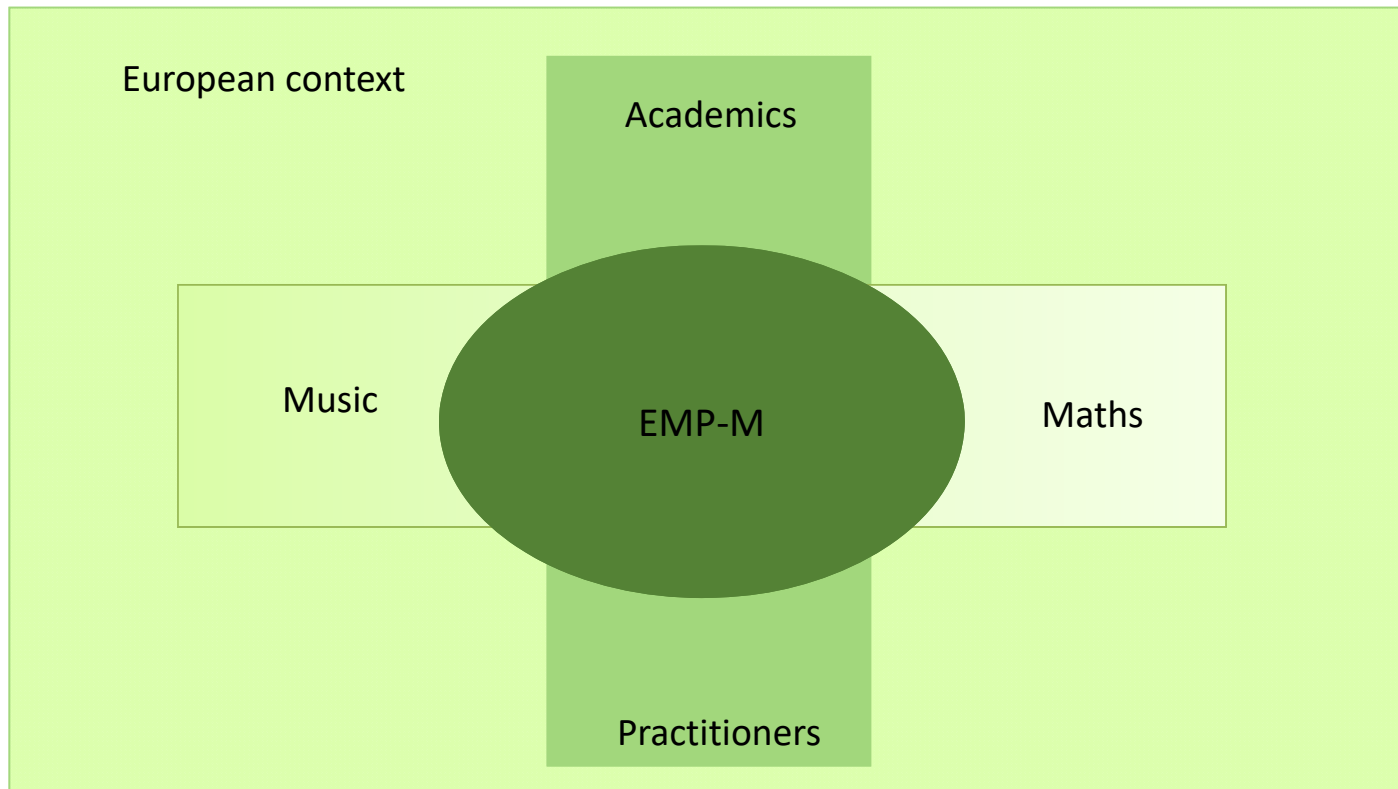
- ... the results achieved in both disciplines
- ... the students' engagement with Maths
- ... the value of Music in education



## What are the challenges we face in our country?



## What are the challenges of working with the EMP-M project?



Samuel Inniger, on behalf of the Swiss  
team

*School of Education, University of Applied  
Sciences and Arts Northwestern  
Switzerland*



Why is the EMP-M project important and what are the benefits?

Today's situation in Swiss schools:

- Integrated teaching is rarely used to seek a holistic approach in Music lessons
- In Maths, musical and auditory approaches only occur when dealing with particular topics

The expected benefits....

- We see opportunities for overcoming the teaching challenges of heterogeneity, gender and inclusion
- The auditory Approach: a help in all school subjects



# Where are we now and where are we going?

A look into the past:

Point of view...

Step 1

**Where are the transfer effects?**  
**1988-1991: Musik macht Schule (Music makes the school), a Swiss longitudinal study**

Ernst Waldemar Weber, Maria Spsychiger, Jean-Luc Patry

Music **to** other subjects

Step 2

**A new understanding in integrated teaching:**

- 2001-2004, the Mathe macht Musik – Textbooks (Maths does Music)

Markus Cslovjecsek et al.

Music **and** Maths  
(Generalists)

Step 3

**A European dimension of integrated teaching**

- 2006-2015, EMP-L (languages) leads to EMP-Maths

Markus Cslovjecsek, Helmut Linneweber Lammerskitten

Music **and** Maths  
(Specialists)

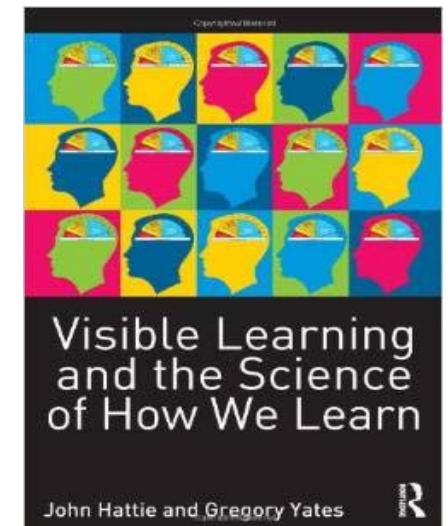
## Where are we now and where are we going?

The point of view of the Research Mainstream?

**Hattie & Yates, Visible Learning and the Science of How We Learn (2013)**

Chapter 23: How music impacts on learning

- Effect of background music
- Mozart effect
- Transfer effects





# Where are we now and where are we going?

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## Step 2: **A new understanding in integrated teaching:**

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## Step 3: **A European dimension of integrated teaching**

- 2006-2015, EMP-L (languages) leads to EMP-Maths

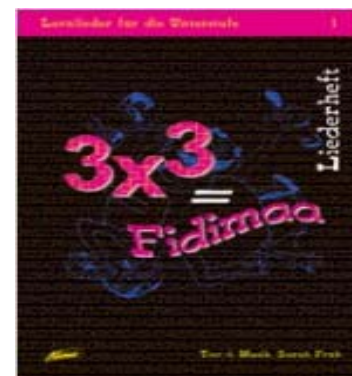
Markus Cslovjcek, Helmut Linneweber Lammerskitten

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## What are the challenges we face in our country?

- Times table Songs (Primary School), **3x3 Fidimaa**

### Seven times table - Song

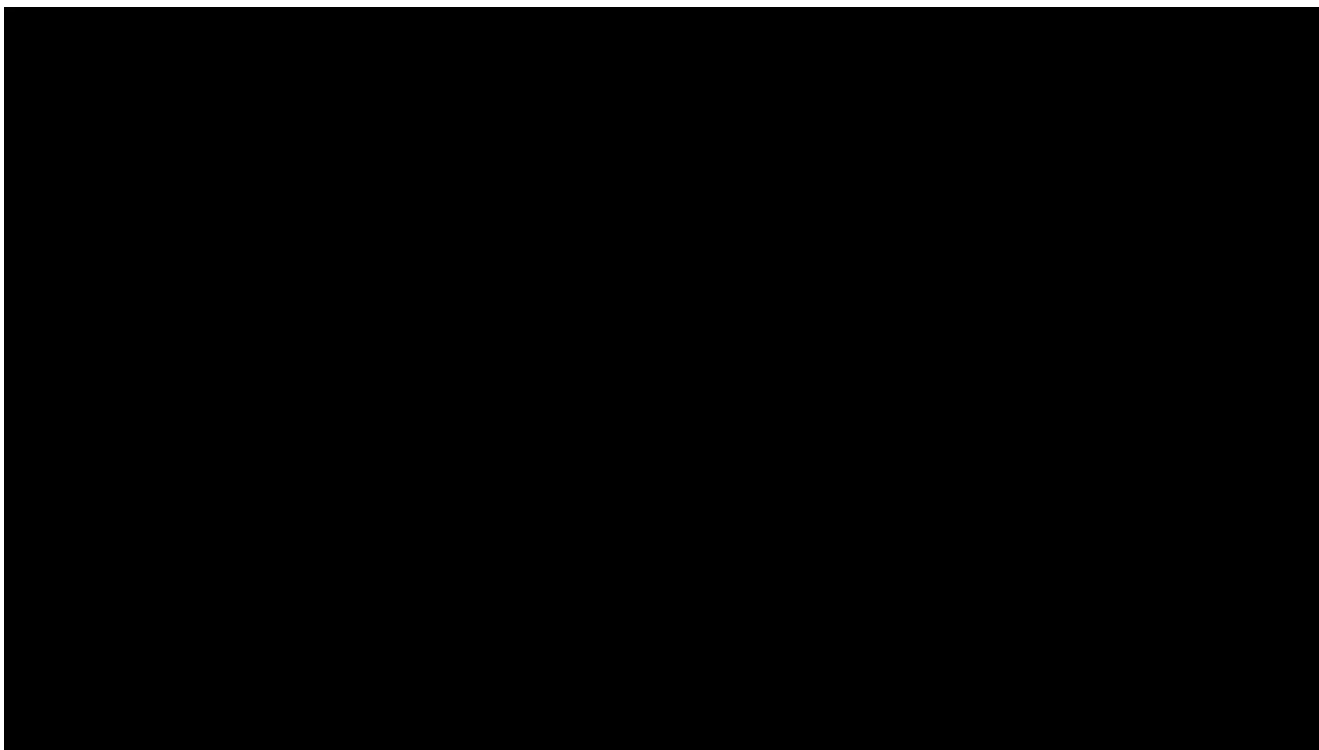


*Translation: Seven, fourteen twenty-one – twenty-eight, thirty-five – forty-two, forty-nine. Hey we are working hard. Only numbers missing are fifty-six, sixty-three, seventy.*

## What are the challenges we face in our country?

- Memorization songs on higher grades

### Phythagorean Theorem



## What are the challenges we face in our country?

The present situation in Swiss schools:

- Integrated teaching is rarely used to seek a holistic approach in music lessons
- In maths, musical and auditory approaches only occur when dealing with particular topics

In Textbooks:

- In maths: musical approaches and musical applications do not occur
- Same situation in music textbooks



## What are the challenges we face in our country?

### Lehrplan 21 (Curriculum 21)



- A new curriculum is being introduced in the german speaking regions
- Integrated teaching forms are mentioned and valued, but not implemented consistently

Die Schülerinnen und Schüler ...	
<b>1</b>	a » können zu Musik phantasieren, das Gehörte ausformen und visualisieren (z.B. malen, bauen, tanzen).

*The learners... are able to fantasize about music, to shape heard sounds and to visualize them (e.g. by drawing, building, dancing)*



## What are the aims, and the expected benefits?

- to rethink and develop Music and Maths Education in dialogue with experts from other fields (outsider's view)
- to learn about other fields in which children are involved in school (holistic view)
- to develop the musical competences of generalists and colleagues teaching other subjects (musical training)
- to offer the sound perspective in education (methodological view)
- to provide more space, more time, more situations, more people for more emotional activities and sound learning at school (change of culture)

## The English team

Caroline Hilton (Mathematics)

Dr Jo Saunders (Music)

Dr Jennie Henley (Music)

Professor Graham Welch (Music)

*UCL Institute of Education, London*



## Where are we now and where are we going?

- The English national curriculum has recently undergone a number of changes
- Music is a universal language that embodies one of the highest forms of creativity
- Mathematics is a creative and highly interconnected discipline

**The national  
curriculum in  
England**  
Framework document  
July 2013





## Where are we now and where are we going?

- No attainment targets
- In music, the change was designed to encourage schools to develop context specific understandings of musical progress, based on the particular musical strengths of the school
- In mathematics, there are now very specific expectations of **what** mathematics should be covered, but less detail in terms of **how** it should be taught



Where are we now and where are we going?

Consider the principles that underpin the new curriculum.

In music, children should be taught to:

- understand and explore how music is created, produced and communicated

Where are we now and where are we going?

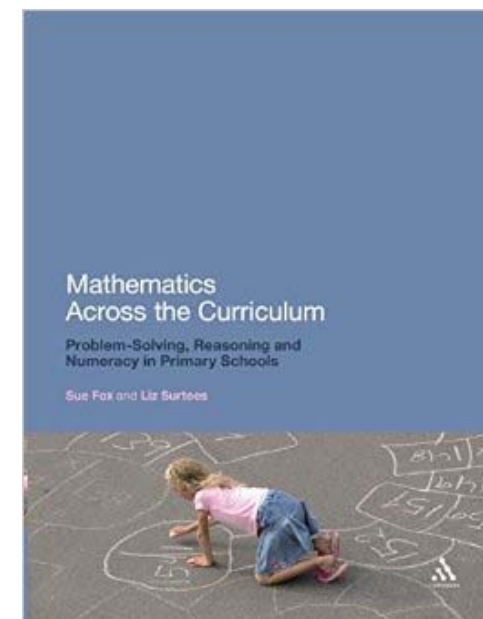
Consider the principles that underpin the new curriculum.

In mathematics, children should be taught to:

- reason mathematically by following a line of enquiry, conjecturing relationships and generalisations
- solve problems by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication

## Where are we now and where are we going?

- In England there is a growing interest in the teaching of mathematics across the curriculum
- Studies have shown that poor numeracy skills are more damaging than poor literacy skills
- In England, both music and mathematics are often believed to be subjects that require talents that are shared by a special minority



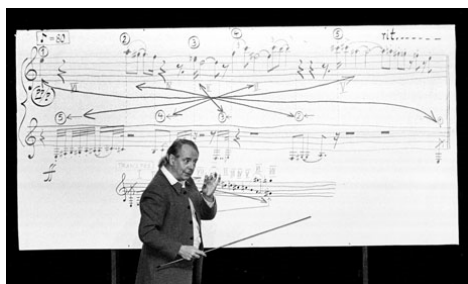
## Why is the EMP-M project important and what are the benefits?

Provides us with a chance to explore ideas that were raised over a decade ago. In other words, we can seek to explore questions such as:

- Music makes significant use of symbolic representation, as does mathematics. Do we use the similarities in the ways symbols are interpreted in both subjects?
- Is the study of pattern in musical forms such as **ABA**, **AABA**, **ABAB** (leading to musical forms such as fugue, sonata and symphonic form) enhanced by pupils' understanding of repeating patterns in mathematics?

## Why is the EMP-M project important and what are the benefits?

- It provides us with a chance to have a stronger cross-cultural perspective that will benefit the pupils and staff in our multi-cultural school contexts
- It aims to ensure that primary generalist teachers feel more confident to teach music **and** mathematics
- It aims to develop a deeper understanding of many of the structures shared by music and mathematics



## What are the challenges we face in our country?

In similar ways to the other examples described previously, there are a number of related contexts that define and redefine the ways in which both music and mathematics learning and teaching take place. For example, challenges include:

- The self efficacy of teachers to work across disciplines;
- Initial teacher education, including an increasing array of school-based routes in which pedagogical models are passed on from teachers to trainees as ‘what works’ rather than facilitating an engagement with underlying theoretical frameworks;
- Initial teacher education, including sufficient time for students to experiment with ways in which to work successfully across both domains;
- The potential disconnect between the official documentation (top down) and day to day practice of teachers (bottom up) and the ‘drift’ that takes place over time;

3

JS to complete

JO SAUNDERS; 14.04.2015



## What are the challenges we face in our country?

Some further examples of the challenges:

- The need for sensitivity as to how this project relates to the ongoing professional development of serving teachers;
- The need to communicate with teachers through appropriate and alternate channels, rather than academic articles and conferences so as to reach a wide and representative population;
- The potential consequences of an unfolding argument in which one subject is seen to serve the needs of another (rather than being valued for its own sake). 'Doing' music helps us to be more musical (and through being more musical other good things happen...)
- External pressures from local and national accountability (SATs, OfSTED, league tables, parental feedback) that can influence the relative valuing of one subject against another;
- The perceived lack of resources as being responsible for the lack of widespread implementation of ideas.

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JS to complete

JO SAUNDERS; 14.04.2015

## What are the challenges of working with the EMP-M project?

Again, echoing previous experiences there are a number of challenges, that at first glance, appear as binary divisions. For example,

- Music and Maths (the ‘arts’ versus the ‘sciences’);
- The ‘atomistic’ vs. the ‘holistic’ (learning from educational neuroscience);
- Academics and Teachers (the ‘thinkers’ and the ‘doers’, the ‘theoretical’ and the ‘practical’, ‘ivory towers’ and ‘working at the chalk face’);
- Tightly defined subject areas and thematic working (exploring the common experiences between subjects, discovering where the two subjects meet, overlap and enhance one another);
- The ‘official’ picture of the national and local documentation (or other published guidance) against the lived reality of pupils and teachers;
- The complexity of working across several different social, cultural and educational contexts as represented by the partner organisations;

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JS to complete

JO SAUNDERS; 14.04.2015

## What are the challenges of working with the EMP-M project?

- The constant need to define terms and understandings so as to facilitate a meaningful discussion...

Is this simply a more obvious manifestation of something that takes place in most research projects of this kind?

Again, echoing previous experiences, there are a number of challenges, that at first glance, appear as binary divisions.

In reality, it is **much** messier and more complex than this.

The challenges exist along a series of continuums.

Over time, we are beginning to make sense of some of these, but the challenges remain.



6

JS to complete

JO SAUNDERS; 14.04.2015

# Math and music, music and *math* - a *new challenge for the Romanian educational system*

Dr. Raluca Sassu

Dr. Mihaela Bucuța

Lucian Blaga University of Sibiu, Romania



Universitatea "Lucian Blaga" din Sibiu

## Where are we now and where are we going?

- Over the last 25 years, the Romanian educational system has continuously changed.
- 2013 - the introduction of the preparatory class as compulsory, mathematics was renamed in mathematics and environmental exploration for the preparatory class, the first and the second grade
- Different hours allocated to mathematics and music, in primary, secondary, and in high school.
- In high school, the number of hours for math and music depends of the main courses (mathematics, sciences, languages)







Universitatea "Lucian Blaga" din Sibiu

## Where are we now and where are we going?

- Mathematics is perceived as a difficult subject for many students.
- Interdisciplinary methods provide opportunities for different teaching strategies - students discover new perspectives and develop new analytical strategies (Korey, 2001).



## Why is the EMP-M project important and what are the benefits?

- The EMP-Math project brings new approaches for learning mathematics and music
- It develops creative and innovative learning solutions
- It enhances the quality of teacher training across Europe
- It offers materials and support for teachers interested in an interdisciplinary approach

## What are the challenges we face in our country?

- Interdisciplinary approaches are a new concept for the Romanian educational system.
- Due to several changes and reforms, the concept is not yet clearly defined.
- In the primary school it is easier to design interdisciplinary courses or lessons.
- Mathematics is more easily included in interdisciplinary approaches to the teaching of biology, chemistry, physics, informatics.
- Music is linked to movement (dance), sport, visual arts, languages.
- The curricula for the secondary and high school do not offer much possibilities and freedom.

## What are the challenges we face in our country?

- The lack of research.
- When we asked primary school teachers about how they integrated mathematics and music, they most often cited the use of number songs
- Examples of teacher studies:
  - Bârjac, S.M. (2015) Enhancing the creativity of primary school students through mathematics. (Creativity is understood as flexible thinking)
  - Neagu, G. (2011) A possible evolution: new technics in music education. (Multimedia technics in music teaching and learning)
  - Roț, V. A. (2015) Study about the didactic play in the preparatory class. (Play and mathematics)
  - Văcărețu, A. S. (2011) Teaching and learning high school mathematics through an interdisciplinary approach. (Learning real numbers through music. Students compose and play a piano/ guitar piece to represent different rational and irrational numbers)

## What are the challenges we face in our country?

- To explore the situation in Romania, questionnaires were distributed to approximately 100 primary school teachers.
- We wanted to find out teachers' opinions about disciplinary approaches and their current classroom practices.
- The results have not yet been analysed in depth. However, all of the respondents:
  - agreed that it is useful to combine subjects
  - that it would be useful to have materials supporting the integrated teaching of mathematics and music

## What are the challenges of working with the EMP-M project?

- Sharing practices from different European countries with different educational systems.
- Recognising shared perspectives, approaches and challenges.
- Having the opportunity for teachers with different backgrounds to work together alongside academics.
- Applicability of the materials developed in the project in different countries.



## Practical activity 2

## NRICH: Clapping Times

For this activity, you'll need to work with a partner, so the first thing to do is find a friend! Together, count from 1 up to 20, (1,2,3...) clapping on each number, but clapping more loudly and speaking loudly on the numbers in the two times table, and quietly on the other numbers.

Now clap the five times table together up to about 30, so this time you are clapping more loudly and speaking loudly on the multiples of five and quietly on the other numbers.

If one of you claps the twos in this way and one of you claps the fives, at the same time, can you predict what you would hear?

Which numbers would be quiet?

Which numbers would be fairly loud and which would be very loud?





NRICH: Clapping Times continued...

Choose another pair of tables and repeat what you have just done.

How about the twos and tens?

Why not try the fives and tens?

Each time predict what you will hear **before** you clap - which numbers will be loud, which fairly loud and which will be quiet?



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