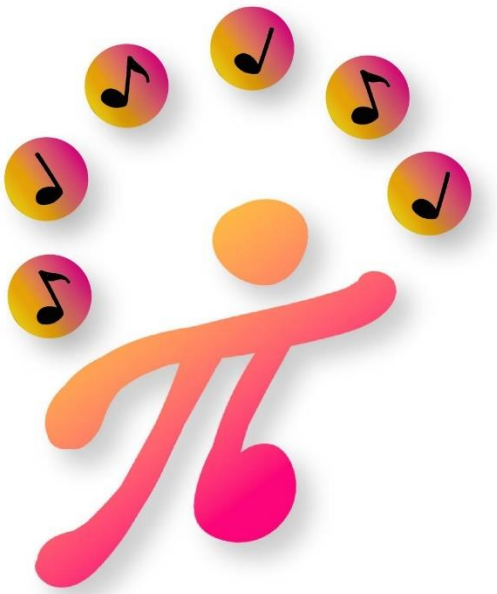
NOVEMBER 30, 2022



TEACHERS GUIDE

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EDUCATIONAL BENEFITS OF COMBINING
MATEMATHICS WITH MUSIC AND CREATIVE MOVEMENT

RESEARCH FOUND BY PROJECT TEAM IN ERASMUS+ 2021-1-SE01-KA220-SCH-000032733

CONTENTS

Musik ist die versteckte
arithmetische Tätigkeit der
Seele, die sich nicht dessen
bewußt ist, daß sie rechnet.

Gottfried Wilhelm von Leibniz
in a letter from 1712.

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Why work interdisciplinary with mathematics, music and movement?

What researchers show us

1. Real Connection between Math and Music

The connection between music and mathematics is so strong that musical experiences and learning enhance mathematical performance.

(Luiz, 2007)

Music and Math are interconnected in sounding ways.

(Mall et al, 2016: 7)

Music can be used to increase mathematical knowledge, academic performance and intelligence in general.

(Kelstrom, 1998:41)

Practically from birth, babies start thinking mathematically and musically. Subitizing is instantly counting without counting out each item. Infants subitize at three or four days old.

(Denison, 2014)

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2. Concentration and Creativity

Making music is a creative process that gives joy in the making, combine making music with solving mathematical problems and this creativity and joy will rub off on the process of learning math.

(Hamilton, 2018)

Art can awaken attention in those that experience it. Music, rhythm and creative movement can help students with their concentration on curricular subjects.

(Moerman, 2018)

Studies have been conducted to prove that increased musical education has positive effects on social behaviour, self-perception and motivation.

(Mall et al., 2016: 7)

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3. Present Abstract Ideas in Concrete Form

Dance can give a visual representation of more abstract subjects in math that are difficult to explain in plain words.

(Rosenfeld, 2011)

The integration of the arts into teaching gives students more opportunities to make connections that lead to deeper understanding.

(Munroe, 2015)

Dance is not the result of mimetic movements, but a combination of perception of space, time, symmetrical movements and directions.

In order to complete a dance movement, it is necessary for the dancer to make certain symmetrical movements, which sometimes he/she does not realize that he/she performed. Since symmetry through natural movements occurs from a very young age in everyday life.

(Belcastro & Schaffer, 2011)

Music is one of the first forms of communication and is often the first contact of children with mathematics.

(Geist & Geist, 2008)

Watson explored using dance teaching to promote engagement and learning in spatial, rhythmic, structural and symbolic aspects of mathematics'.

(Evangelopoulou, 2014)

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4. Visual Representation of Mathematics

Dance and creative movement can give a visual representation of angles, geometric forms and spatial perception.

(Rosenfeld, 2011)

Developing students' conceptual understandings of mathematics through multiple types of connections, representations, and communication.

(An et al., 2017)

When using the space of the classroom and the numbers we have around us we can give the children a new level of the understanding of mathematical concepts

(Moerman, 2016)

Music gives a range of ways to understand mathematics as pattern building, comparing and ordering, describing what one hears and sees and solve problems, make music!

(Johnson & Edelson, 2003)

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5. Team Building, Class Management and Inspiration

The use of body percussion and eurythmic games helps to improve the integration level of all students in the whole class.

(Lundberg, 2014)

The discipline, concentration and closeness in dance can help strengthen students' sense of empathy, co-operational skills and respect for one self and others.

(Robinson & Aronica, 2018)

Teaching math through dance is not only inspiring and rewarding for the kids, also teachers have experienced improvements of inspiration, joy and understanding in what they teach.

(Rosenfeld, 2011)

Art-themed mathematics education activities have been proven to increase teachers' innovative capabilities and strengthen their pedagogical self-esteem.

(An et al., 2019)

In integrated classrooms, where music and movements are used combined with mathematical problem-solving, group dynamics are boosted and children become more active in their learning process, making them reach curriculum goals more easily.

(Moerman, 2016)

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6. Universal Communication

To work with teaching through dance is more inclusive and is a good way to work in classes with multiple languages. Students learn to communicate about dance through math and math through dance.

(Rosenfeld, 2011)

Integrated math and dance lessons helped teachers to meet the children's different needs

(An et al., 2017)

Dance is speechless but can give an extra dimension to the communication within a classroom. In a multi-linguistic class this can help ease the language-obstacles

(Moerman, 2016)

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7. Overbridge Anxiety and Math Phobia

Some teachers tend to focus on the ability to understand mathematical concepts and neglect negative mathematics dispositions. Incorporating art into the mathematics classroom are shown to improve mathematical disposition and also performance in math.

(An et al., 2014)

To work with dance and movements in the math classroom can sometimes make the kids forget that they are learning math, and hence their phobia of math disappears. The same can be true for kids with a personality that likes math more than dancing and moving, the math makes it easier for them to join in on the dancing.

(Rosenfeld, 2011)

Dance-themed mathematics education helped "improving students' dispositions toward mathematics and creating an enjoyable learning environment for reducing mathematics anxiety".

(An et al., 2017)

Music, rhythm and dance can help children forget about their social anxiety and also their fear of not understanding the math that they feel they are supposed to understand in the class room.

(Moerman, 2016)

Music can give joy in learning math for those children that do not have a strong logical thinking and math can strengthen those children that do not have knowledge in music to play instruments.

(Johnson & Edelson, 2003)

It is shown that students remember more thoroughly what they learn if they gesture while they are learning.

(Cook et al., 2008)

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8. Overall Benefits of Music Integration in Class

'Music can activate the same reward centre in your brain as the other things you enjoy. Rewarding yourself with your favourite music can improve the motivation you need to learn new information'.

(Gold et al., 2019)

Integrating music activities into learning routines enables children to develop learning experiences in a playful and engaging way.

(Vaiouli & Friesen, 2016)

Music creation is the only one that activates most parts of the brain as opposed to any other activity.

(Scripp & Gilbert, 2016)

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APPENDIX 1

The Work Done

CONTENTS PPR1[1]

- Need Analysis (Focus Groups of teachers)
- Research to show relevance and importance of music and movement in Maths in the field of STEAM approach
- General knowledge of Music and Movement that correlate with Maths.
- Multicultural approach through historical facts and other theories (Pythagoras, Plato etc).

TASKS FOR TEACHERS GUIDE PPR1

1. Collection of results
2. Design and Development of Teachers' Guide
3. Piloting and assessments
4. Finalization and Translation

Questions for teachers focus groups before implementation of project m²-cm

1. How many years of teaching experience do you have
2. What challenges do you face nowadays in classroom
3. What's your classroom clima this year
4. Do you face any challenges in teaching Maths? If so can you please name some?
5. Do you use any alternative teaching methods in the Maths classroom? Ifso, can you please clarify?
6. Do you believe that the application of alternative teaching methods can affect the learning procedures and results?
7. Do you have any previous music knowledge? Please clarify.
8. Would you feel comfortable integrating music or creative movement in your Maths Teaching?
9. Do you think there is any connection between maths and music or Creative movement? If so please clarify
10. Do you believe that integrating these two elements would bring positive effects on students' learning results? If so, in which areas?
11. Do you believe that following some training you would be able to fully integrate music and creative movement in Maths teaching?

Answers from Focus Group in Cyprus 2022-05-15

Answers from Focus Group in Sweden 2022-03-17

[1] PPR means Project Production Result in Erasmus+ projects

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APPENDIX 2

The Ideas Behind

The European Union needs more STEM!

The Erasmus+ project application guidelines stress the importance of increased STEM competence in the European Union. We need more:

Scientists, who organize and verify observations and results.
Engineers, who focus on theory and design and who, with the help of
Mathematics, transform the observations into practical reality.
Technologists, who focus on production, maintenance and repair of engineers' design.

How can Increased STEM Skills be Achieved?

THIS IS THE ANSWER FROM ERASMUS+ 2021:

The Arts can - just as Mathematics - be tools for the Scientist and the Engineer as well as the Technologist and the student! The Arts should be integrated in all STEM education!

THIS IS THE ANSWER FROM ERASMUS+ PROJECT M^2-CM:

In our project, which is based on above guidelines, Music and Dance will be used to consolidate and increase students' knowledge of Mathematics to prepare them for further studies.

At the same time, Dance and Music have an intrinsic value in the project, for the individual student as well as for the security and joy of the group.

WE ARE:

- experienced educators in the school's lower stages in Sweden, Greece and Cyprus and
- experienced educators in Music and Dance in all three countries together with
- experienced researchers and educators at the Technical University of Crete.

WE WANT TO:

- broaden students' perceptions of what Mathematics can be,
- make Mathematics comprehensible to all students,
- increase interest in Mathematics,
- strengthen students' Musical and motor abilities,
- create creative and safe learning environments and
- design, test and produce a digital education for teachers where Mathematics, Dance and Music are integrated!

The Project Team

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