



Project in Mathematics and Citizenship

Initial teacher education course





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Introduction

The Project in Citizenship and Mathematics (PiCaM) embeds critical global learning in the teaching and learning of mathematics in school. Curriculum materials have been devised for initial teacher education (ITE) students to explore together. The focus will be on 10-12 year olds but many of the materials produced are suitable for a wider age range with minor adaptations.

The project is led by Sheffield Hallam University in England and has partners in five countries: Development Education Centre South Yorkshire, England; Aga Khan Foundation (PT), Portugal; University of Thessaly, Greece; University of Bucharest, Romania; Mathematikum, Germany. Links between ITE students on practice in these partner countries will be fostered through eTwinning activities that form an integral part of the curriculum materials. This ITE Course serves as an introduction to the thinking behind the project and its implementation. Tutors/course facilitators can select any of the mathematical activities for students to try out and organise the course in a way that suits their local contexts and addresses PiCaM's [intended outcomes](#). By the end of the course students will have:

- experienced and reflected on PiCaM curriculum materials
- an understanding of the underlying global citizenship concepts
- an awareness of how P4C related approaches can be used to deepen pupils' understanding of Mathematics and Global citizenship.

In the final session, students are encouraged to share their experiences of using the materials in the classroom and provide feedback on these materials. Students are encouraged to record ongoing reflections about their own and pupils' responses to the activities using e.g. a padlet, a class display board, a diary (by the **students** and/or pupils, tweets or Facebook etc.).



Organisation of the course

The course represents 10 hours of supported ITE student learning and a further 10 hours independent study and preparation for teaching. It is divided into four modules each covering two to three hours of study time. These modules have been designated as core (modules 1 & 2) and follow up modules (modules 3 & 4). This facilitates a variety of different delivery patterns, some of which might include some distance learning. For example, modules 1-4 might be offered as part of the regular ITE programme with students working on one module each week. Alternatively, modules 1 and 2 might occur as a single day-long event with an option for a similar pattern for modules 3 and 4. Other models are also possible depending on local circumstances. Students are encouraged to plan collaboratively, to explore opportunities to use the activities in their teaching practice and as a starting point for small research projects. For example, in England some students chose to use 'Playing and making Mathematical games and craft: spaces for coming together' as a stimulus for their work on mathematical talk.

Modules

The four modules are as follows:

1. Balance and Interdependence: Patterns and connections
2. Mathematics and P4C pedagogy in PiCaM
3. Intercultural exchanges: Maximising opportunities
4. Mathematics and P4C pedagogy revisited: Conjecturing and checking things out

Mathematical and Global Competences and Topics

As part of the first module, participants are invited to consider what the world is like today, and how it might be in the future, and then to suggest the knowledge, understanding, skills and dispositions required to be a global citizen in a world that they describe and predict. This is a prelude to introducing the global and mathematical competences developed from **PiCaM's Conceptual and methodological principles**. [PiCaM classroom activities](#) are exemplified in each of the four modules. Course participants are then given an opportunity to mark off which competences they feel



are addressed by each activity using the **PiCaM activity analysis grid** on the following page.

PiCaM Activity Analysis Grid

MATHEMATICS COMPETENCES	
1) LOOKING FOR PATTERNS & CONNECTIONS	
2) ASKING YOURSELF QUESTIONS	
3) BEING SYSTEMATIC	
4) BEING RESILIENT & FLEXIBLE	
5) CONJECTURING & CHECKING THINGS OUT	
6) VISUALISING, IMAGINING & USING INTUITION	
7) USING EMBODIED & MULTI-SENSORY APPROACHES	
8) USING REPRESENTATIONS & SYMBOLISM	
9) MODELLING & DEALING WITH UNCERTAINTY	
10) USING ANALOGIES	
11) USING ARGUMENTATION & REASONING	
GLOBAL CITIZENSHIP COMPETENCES	
A) CAPACITY TO EXAMINE GLOBAL ISSUES	
B) APPRECIATE DIFFERENT PERSPECTIVES & WORLDVIEWS	
C) POSITIVE INTERACTIONS WITH PEOPLE WHO ARE DIFFERENT	
D) TAKE CONSTRUCTIVE ACTION FOR S.D. & SOCIAL WELL-BEING	
E) ANALYTICAL & CRITICAL THINKING SKILLS	
F) COMMUNICATION & CO-OPERATION SKILLS	
G) CONFLICT RESOLUTION SKILLS	

Mathematics Curriculum Topics	
Numbers & Place Value	
Number Operations	
Fractions & Decimals	
Measurement	
Geometry (Space & Shape)	
Functions, Sequences & Algorithms	
Algebra & Equations	
Data, Stats & Randomness	

Global Citizenship Topics	
Inequalities & Hierarchies	
Institutions Conflicts & Human Rights	
<i>Buen Vivir (social ecological integration)</i>	
Environmental Sustainability	
Legacy of Colonialism	
Socio-economic Development & Interdependence	
Alternative Knowledge Systems	
Culture & Intercultural Relations	



Modules

1. Balance and Interdependence: Patterns and connections

Brief introduction to PiCaM: Citizenship, mathematics and Philosophy for Children (P4C).

Ask participants as a whole group to come up with any words they can think of to describe the world today. Write these words out large on a flipchart with a thick marker pen so they are visible to all.

Now ask participants in groups, each sitting around a table with a sheet of flipchart paper and coloured marker pens, to create a learner who has the competences to be an effective and responsible citizen in a world as it has been described in the previous activity.

Hand around copies of the **PiCaM activity analysis grid** and ask people to call out if they notice any correlation between the competences they came up with for their learner and those of the PiCaM project. **The PiCaM Conceptual and methodological principles** to which you might wish to refer, provide some background as to where these ideas come from.

Outline the ITE student course and briefly describe the intended ideas for the e-twinning. Students share their existing experiences of using activities and approaches to promote global citizenship and develop competences in mathematics. Discuss project evaluation and related research, providing further information as appropriate.

Introduce curriculum activities, encouraging participants to work together through some of the tasks and then to map them against mathematical and global citizenship competences and topics using the **PiCaM activity analysis grid** (on the previous page).

Suggested activities (all available from the [PiCaM website](#))

Fair and square: Magic, Latin and Vedic squares (e.g. Tasks 1-3)

Designing the world around me: Mathematics and cultural inspiration in design (e.g. Tasks 1-3 & 5)

Encourage students to explore the materials with their practice classes and be prepared to feedback on these in subsequent sessions.

Make available copies of the **Conceptual and methodological principles** for the curriculum materials, eTwinning and teacher education modules.



2. Mathematics and Philosophy for Children (P4C) pedagogy in PiCaM

Thinking mathematically about global citizenship requires good thinking and reasoning skills. In this session we explore how using a philosophical approach (P4C) can enable students to support pupils' thinking and reasoning about mathematics and global citizenship. Some background to P4C including the 10 steps of an enquiry will be provided on the PiCaM website. Students will also learn how to include critical, collaborative, creative and caring thinking (4Cs) through philosophical games, activities and dialogue. They discuss the opportunities and challenges the PiCaM materials and pedagogy raise.

The Philosophy for Children (P4C) approach in PiCaM

This brief introduction is intended to familiarise partners with the P4C pedagogy

1 Begin by showing a clip from SAPERE's video

<https://www.youtube.com/watch?v=awr4lnsWRkA>

2 Ask participants to reflect on what they noticed about the teacher and pupils

(Pupil's mostly talking, pupils talking and thinking, sitting in a circle, teacher facilitating)

3 Provide a brief intro to P4C

P4C originated in the USA in the late 1960s and versions of it have since spread to around 60 countries across the world. It came to the UK in the 1990s following the televising of a BBC programme called '[Socrates for Six Year Olds](#)' where Professor Matthew Lipman and Ann Sharpe at Montclair State University, New Jersey explained the aims and methodology of P4C and showed its successes with children as young as six.

4 Share the quotes on 'Philosophy' and Philosophy for children (P4C)

Philosophy

'Philosophy attempts to clarify and illuminate unsettled, controversial issues... the aim is to cultivate excellence in thinking' (Lipman, 1988)

Philosophy for children (P4C)

'way of thinking together and sharing thoughts and questions about the big ideas'

5 Introduce two ways of incorporating P4C into PiCaM. Both approaches incorporate the 4 Cs - Critical, Caring, Collaborative and Caring thinking.

5.1 The pupils in the video clip above were taking part in a whole class inquiry that followed this outline:

- Set ground rules: (e.g. listening, one person speak at one time, etc.)
- Stimulus: (e.g. the jigsaw puzzle piece)
- Asking questions
- Voting for a question
- Sharing first thoughts
- Discussing
- Sharing last thoughts
- Reviewing the enquiry

Example:

Fair and Square: Magic, Latin and Vedic Squares

Task 7 – A Philosophy for Children Enquiry

As magic squares contain harmonious patterns and proportions of number, certain patterns of mathematical proportion exist in nature. The short film '**Nature by Numbers**' by Cristobal Vila is an excellent P4C stimulus and can lead to philosophical questions about creation, life, patterns, determinism and related topics.

5.2 The teacher can incorporate games using the TCJR technique (Think, Commit, Justify, and Reflect) to explore Global citizenship or Mathematics (or both) concepts/provocations.

5.3 The curriculum activities below use these two pedagogical approaches:

Example 1:

Playing and making Mathematical games and craft: spaces for coming together.

Task 2 - Play a game

Task 2: TCJR - The 'ingredients' game

What 'ingredients' (skills/attitudes/knowledge) are needed to play this game well?

What is the most/least important (TC): Place the ingredients on a continuum line from most to least important

Justify reasons/Reflect on reasons (JR): Tell the person near to you what your reason is and then ask for reasons from the whole group allowing participants to change their minds as they reflect on what they hear.

Example 2:

Global crises and local solidarity: Debt vs money as a common good

Task 1: Explore 'crisis' & 'solidarity' in global and local contexts with children

Task 2: Reading data found in public media

Stimulus: visual images of 'crisis' in the media

Generate questions, vote for a question, discuss (using 4 Cs)

Task 3: Money is not free to borrow from banks and pawnshops

Describe/discuss banks and pawnshops - provide choice between the two – 'Where would you rather get money from?'

Think, Commit, Justify, Reflect (evaluate own and others reasons)

Further information: SAPERE website - www.sapere.org.uk

Preparation for gap task: An overview of one or two activities is provided. Students agree on activities to explore with their practice classes. They map the four Cs of P4C against the curriculum activities and consider how they might use these in practice.

3. Intercultural exchanges: Maximising opportunities

In this session we focus on supporting student teachers to understand how they might collaborate with other project schools through the **eTwinning** platform. One or two activities are introduced and **students** consider how they might work through the activities to maximise intercultural exchanges.

Suggested activities

Playing and making mathematical games and crafts: Spaces for coming together (E.g. Tasks 1 and 2 [Steps 1 and 2])

Global crisis and local solidarity: Debt vs money as a common good (E.g. Tasks 1 and 2)

The face of a country in fractions: Exploring land use with mathematics (E.g. Tasks 1 and 2)

Getting started on e-twinning

Step 1: Login

Once in your eTwinning account (www.etwinning.net), go to eTwinning live. (If you do not already have an account, you will be able to register as a student teacher.

Alternatively, you may be able to support your host teacher to participate when you are in your practice school).



Step 2: Join PiCaM-related projects

In Projects section, type “picam” and click on Search.

Once you have identified a convenient project by thoroughly reading the preliminary description, contact the initiator expressing your interest to join. You can do this by writing a private message to any of the partner teachers or ITE students (preferably, to initiators). They will add you as a project partner, assigning you the role of member or admin. You can then visit the Pages section of the Twinspace for the project to collaborate.

Step 3: (Re-)Design the Project

According to your curriculum and pupils’ needs, elaborate the eTwinning activities plan, together with the other teachers or ITE students participating.

Note: It might be possible that, at the time of your search, none of the projects listed there will be open to receive new partners. In this case, repeat your search periodically OR initiate a PiCaM kit-based project yourself. Instructions on how to do this, together with some example toolkits for eTwinning around PiCaM activities will soon be available on the PiCaM website.

Preparation for module 4: in this module we will draw out the connections with global citizenship topics, and competences, relating these to the mathematical competences demanded by the local/national curriculum. Students are asked to bring current activities to the session, focussed on conjecturing and checking.

4. Mathematics and P4C pedagogy revisited: Conjecturing and checking things out

In this session we revisit and further explore the pedagogical approaches introduced in module 2, working with PiCaM curriculum activities and contributions from local curricula. Students explore the connections between global citizenship topics, and the demands of the local/national curriculum. We consider how global citizenship may provide a thread to connect prescribed mathematics activities whilst also opening up opportunities to include some of the PiCaM activities.

Suggested activities

Mathematical bodies (E.g. short examples from Tasks 1 to 4)

Mapping our world with mathematics (E.g. examples from Tasks 1 to 4)

Perceptions of Time: Cultures and Calendars (E.g short overview)

This session is also intended to provide students with the opportunity to share their experiences (including with e-Twinning) with using the materials in the classroom and to consider further developments building on the approaches and materials.

ITE Students taking part in a 'Fair and Square' activity





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