Multiculturalism, Migration, Mathematics Education and Language

M³EaL Project International Workshop

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Teaching materials (draft)

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AT Teaching Unit

Who did what in mathematics in my country?

Andreas Ulovec – University of Wien

Topic

History of mathematics

Aims of unit

Using cultural background of students from different countries to find out that

mathematics is a truly international and intercultural subject.

Target schools - teachers - students

general application

Short description

The students work in small groups (approx. 3 members each), if possible, with at least 1 student with a migrant background.

The activity takes place in 5 sessions

1 session. Introduction and explanation of group work

The teacher gives a short general introduction into the history of mathematics by an overview of timeline, placing of most important concepts [of school mathematics' topics] and most important names from different cultural backgrounds

2-3 sessions. Actual group work

The students carry out their search (by using the school library, internet resources …) finding out about mathematics that has been developed in their country of origin or in their culture, and/or about famous mathematicians of their culture.

4 session. Poster design

Each group design posters with their results.

5 session. Presentation

Each group present them in class; each presentation ends with a short question-and-answer session.

CZ Teaching Unit

Ornaments in teaching symmetry

Jarmila Novotna & Hana Moraova
Faculty of Education - Charles University in Prague

Topic

Geometry: concept of symmetry ; preconcepts of

area and perimeter; concept of proportionality.

Aims of unit

Using the cultural content of ornaments to practice certain mathematical

structures and eventually establish cross-curricular links (e.g. Art).

Promoting integration of migrant pupils into the classroom.

Target schools - teachers – students

- **Lower secondary schools (6th-8th grades).**
- **pre-service and in-service mathematics teachers.**

Short description (originally proposed teaching unit)

The activity is structured in 2 lessons and is carried out in the class

Lesson 1 "*Ornaments*"

- **revision** of symmetry concept using different types of letters and finding out symmetry elements
- **presentation** on types of ornaments in different cultures
- **show** the different types of symmetry and transformations
- **first individual analysis** of elements of symmetry in some ornaments, with finding out and copy all symmetrical geometrical figures contained therein
- **discussion** about typical ornaments of a particular culture
- **search** of ornament decorated object at home

Lesson 2

- **presentation** and **description** of the collected ornaments (type, line symmetries, …)
- **individual student work** on particular ornaments (Celtic, Native American, Arabic rosette) using a square grid with different scales where copy the ornament pointing out lines of symmetry and solve problems on figures' area and proportionality area-scale.

Short description (piloted teaching unit in the 5th grade)

The activity is structured in 2 lessons and is carried out in the class

Lesson 1

- **introduction** to ornaments with discussion on types, shape, differences in cultures, basic elements; discussion of Native Indian ornaments (made of beads)
- **individual work** in two times using two Native American ornament (of different structural complexity) and a square grid where copy them (square by square, accurately) and to which refer for calculating the number of squares of each colour, the size of the different colored figures … approaching to area and perimeter questions.

Lesson 2

- **presentation** of two original Native American ornaments and **discussion** about the figures the pupils can find out in the structure
- **individual student work** on an ornament model having indicated line of symmetry with the task to finish the ornament.
- **making** models of ornaments using beads, threads … etc.

Homework

- **searching** for ornaments at home, observing types, shapes, colours, materials and copying them to continue the work…

FR Teaching Unit

Magic square

Marie-Hélène Le Yaouanq - Université Paris Est Créteil - IUFM

Topic

Arithmetics: numeration and additive connections ; Semiotics (sense of signs).

Aims of unit

Working on a decrypting problem, to develop sense of signs and to improve language skills in understanding and writing a text and in argumentating (explaining plans/solutions)

Target schools - teachers – students

Lower secondary schools (7th grade)

Short description

The activity is structured in 3 phases and is partly carried out in groups.

Phase 1

- **presentation** of the work consisting in decrypting an old chinese document: a magic square
- **personal search online** about what a magic square is
- **collaborative writing** of a summary
- **personal solution** of problems (on recognition/completion of a magic square)

Phase 2

- **presentation** of the square transposed with pictures which involves the use of excel file automated for teacher.
- **posing** of questions “ad hoc” first to be faced individually and then to be discussed in groups
- **pooling of groups**.

Phase 3

- **resuming** the work on the starting magic square and decoding Arabic numerals within it

GR Teaching Unit

Putting bins in our School's yard

Charoula Stathopoulou & Heleni Gana
Department of Special Education - University of Thessaly

Topic

Geometry: space notions, measure, scale, proportion

Aims of unit

To connect mathematical notions and techniques with a real life problem without well-defined procedures.

To promote the social communication of ideas in different discursive patterns and the negotiation of reasoning.

Target schools - teachers – students

Lower secondary schools (7th grade)

Short description

The activity is structured in 3 phases and takes place in groups.

Phase 1

- **introduction** to the task
- **collection** of suggestions to go on with it and **choise** of the action strategy (i.e.to take measure the schoolyard sides in order to develop a model …)

Phase 2

- **selection** of suitable measurement tools and **planning** how to transfer them on the map unto the **realization** of the need of a suitable scale
- **implementation** of the measures and **design** of maps

Phase 3

- **use of a dynamic geometric tool** (geogebra) to try several sizes of the yard (similarity) and several positions of the bins.
- **dialogic construction** of the final text of the official letter

IT-PI Teaching Unit

Mastering maths, mainstream and minority languages

Franco Favilli – Dipartimento di Matematica – Università di Pisa

Topic

Mathematical language

Aims of unit

Focusing the role of the language in the mathematics teaching/learning process.

To provide ways to overcome the difficulties in mathematics of pupils from cultural minorites due to their poor knowledge of the vehicular language.

Target schools - teachers – students

- **Lower secondary schools (6th-8th grades) in socio-culturally diverse areas.**
- **Mathematics teachers.**
- **Students from cultural minorities and/or culturally deprived groups.**

Short description

The activity is carried out in small groups, each of which with a minority pupil.

It involves the fields of *vehicular/natural/mathematical languages*.

Phase 1: *text analysis.*

Different texts are used - **pages of a textbook** and "**word problem**" in a national valuation test - aiming at

- **drawing up a *micro-dictionary*** by

search for and **list** of words /verbs in the *vehicular language* that are **"difficult"**

discussion about their meaning

translation into the foreign languages spoken in the classroom

- **drawing up a *maths glossary* (for words) and a *maths dictionary* (for verbs)** by **search for** and **list of** words/verbs that are proper of the *mathematical language*

comparison to the same words/verbs in the *natural language*.

discussion about and **writing** the words/verbs having **different meaning**

translation into the foreign languages spoken in the classroom.

Phase 2 : *text construction*

The activity now concerns

- **re-writing**

the analyzed texts in the *vehicular language* (all groups) and **the most significant sentences** in the *national language* (minority pupils)

- **writing**

in the *vehicular language* both a **"page of a textbook"** (about a mathematical topic chosen by the teacher) and a **word problem**

with following **discussion** about clarity of the texts produced

- **testing**

the ability to make a proper use of the geometrical language, performing the Geometrical Puzzles activity from the LOSSTT-IN-MATH project.

IT-SI Teaching Unit

A factory of triangles

Maria Piccione - DIISM - Università di Siena

Topic

Geometry: triangular shape concept; congruence relation, similarity relation and corresponding criteria for triangles

Aims of unit

To support conceptual representation by producing a lot of mental images ; to develop language and to promote social interaction in a context of structured sensorial experience.

Target schools - teachers – students

- **Lower secondary schools (6th-7th grades)**
- **Mathematics teachers.**

Short description

The activity takes place in small groups, each of which with a minority pupil.

It is structured in 3 phases.

Phase 1

- **exhibition** of the didactic material (rods and hooks) and showing how to join pieces together in order to build articulate models of figures
- **free contruction** of compositions choosing and linking sticks together and drawing the nicest ones

Phase 2

- **composition** of figures by three sticks; calling to mind of triangular objects from the real world
- **making collection** by selecting photos or visiting websites dealing with the triangle
- **discussion** about the importance and the fortune of this shape

Phase 3

- **finding conditions** of triangle existence by comparing the possible different configurations : closed/open figures and observing their uniqueness or not
- **checking out** the spontaneous use of terms and taking note of conclusion
- **going on constructing** triangles under conditions (*one given side; one given side & one given angle)*
- **problem posing session** leading to the understanding of conditions of uniqueness
- **seeking and organizing** comments
- **final exibition** of whole activity

NO Teaching Unit
Multiplication

M.Claire Berg & Barbro Grevholm - Dept of Mathematical Sciences-
University of Agder

Topic

Multiplication from different approaches

Aims of unit

To promote reflection about the process of multiplication, realizing the properties of multiplication, seeing links between multiplication and other areas of Mathematics, learning how multiplication is dealt with in their own countries.

To develop awareness that mathematics is constructed and used by ordinary people in many parts of the world.

Target schools - teachers – students

Lower secondary schools (6th-8th grades)

Short description

The students work …

The activity takes place in 4 sessions

1. **presentation** and **study** of a particular *number pattern* from an ancient handwritten book; question guided group **discussion**, **explanation** about the possible use of the tables in the given picture, and related **problem solving** work.
2. **presentation** of a way of multiplying numbers (between 5 and 10) with fingers and highlighting its convenience
3. **search, analysis and comparison** of other ways of finger multiplication (known since historical time and come from traditions in different countries);

   request for **explanation of the method** without using language

4. **summarising discussion** about what has been learnt.