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Case study C

Basic data

Title of Research Teaching Unit	**Measuring sports ground dimensions in different units**
Unit created by	**Da Vinci School, Prague (CZ)**
Based on Concept	**Massa - Green Geometry**
Concept created by	**Istituto Comprensivo "Malaspina"**
Date of teaching	**24/11/2023**
Number of students in class	**17**
Number of migrant students	**2**

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1. Unit Description of Research Teaching Unit

Title	**Measuring sports ground dimensions in different units**
Teaching unit concept	Massa - Green Geometry
Age of students/grade	12-13 y.o., year 7
Length of the unit	60 min
Mathematical topic	Units of length
Prerequisite knowledge	● metric units of length and their conversions
Materials needed	● various measuring instruments (rulers, tape measure, string)
Objectives	To enable students to become familiar with different units of length in an experiential way. To guide students to think about the accuracy of measurement when using different measuring instruments. To develop group work skills in a heterogeneous group.
Notes on work with migrant students	Units of length in different cultures and historical periods.

Lesson plan

- The teacher introduces the topic of the lesson (Length measurement and units of length). He/she invites migrant students to share what units are used in their home country to measure length. A discussion follows about how people measured dimensions and distances in the past.
- If there are migrant students in the class, divide them into groups in such a way that they work with non-migrant students in groups of two to four.
- The teacher distributes the worksheet to the groups of students, has them read the first paragraph of the instructions and the first task, and clarifies any unclear points. He/she then goes to the school playground or other suitable outdoor area for measurement.
- Students work in groups on assignments from the worksheet. The teacher coordinates and monitors group work, providing help when needed.
- The teacher encourages the groups to pair up and to share the results of the measurements.
- Upon returning to the classroom, a group discussion and reflection on the activity follows.

Worksheet - Length and its measurement

Length is one of the fundamental physical quantities. It indicates the dimension of bodies (length, width, height, depth) or the distance between two points in space. The oldest units of length were derived from the sizes of human body parts: thumb, palm, fist, foot, elbow, step, and others. Different units were used in different parts of the world. Over time, there was a need to unify the units of length, and so the metre was defined. After several changes, since 1983 the metre is defined as the distance travelled by light in $\frac{1}{299\,792\,458}$ seconds.

Task 1:

Using your own bodies in the group, choose three units of length suitable for measuring the dimensions of the school playground and use them to measure the playground. You are not allowed to use any measuring devices other than your body parts. Record the data in the table, think of a name as well as a symbol for each unit and write them in the table.

	Name and symbol of each unit		
Length of the ground			
Width of the ground			

Task 2:

Using a suitable measuring device, convert the data in your own units to metres and record them in the following table. Reflect on the variation and accuracy of the calculated data. Also record the conversion relationship between your units and metres, e.g. 1 arm = 0.75 m.

	Measurement 1	**Measurement 2**	**Measurement 3**
Length of the ground			
Width of the ground			

Task 3:

Use the tape measure to measure the dimensions of the ground in metres and compare them with the figures in the table in task 2.

Task 4:

Even today, some countries use units of length other than metres. This is particularly the case in the UK and the USA. Although the UK officially adopted the metric system in 1995, some of the original units are still in use today, not only by the population but also officially. The following table lists the original British units and the relationships between them and metric units. Using a calculator, complete it by converting each unit to metres.

unit	**symbol**	**conversion relationship**	**conversion to metres**
inch	in, ″	1 in = 2,54 cm	
foot	ft, '	1 ft = 12 in	
yard	yd	1 yd = 3 ft	
furlong	fur	1 fur = 660 ft	
mile	m, mi	1 mi = 1760 yd	

Task 4:

Look again at the dimensions of the ground you have measured. Choose the ones you think are most accurate, write them down in the table and convert them to the given units.

	in	ft	yd	mi
length				
width				

Task 5 (bonus task):

Calculate the area of the pitch in square units (metres, feet, your established units).

2. Interview Analysis

The teacher teaching of this unit is an experienced teacher of mathematics with a teaching practice of 18 years. Her other subject she teaches is chemistry. She focuses on teaching mathematics to lower secondary school pupils but teaches at upper secondary school level as well. The teacher received no pre-service training in work with migrant pupils and no in-service teacher training in the issue before the last 12 months. However, she attended the in-service teacher training conference in Prague at Charles University organized within the frame of the M4M project.

Da Vinci school, where the lesson was conducted, is a private school where individual needs of each of the learners is respected.

The teacher does not have rich experience of teaching migrant pupils.

The lesson was conducted with sixteen students aged 14. Two of them had migrant background and were in the Czech Republic more than a year.

The objectives of the lessons were recognition and naming of solids with the aim of developing pupils' ability to use correct terminology when working with solids. The structure of the unit was from evocation to group work and reflection.

What could be observed in the lesson and was mentioned in the interview was the pupils' struggle with use of correct terminology. What worked really well was working with real-life objects and modelsThe atmosphere in the lesson was friendly, cooperative and respectful.

The cross-curricular character of the activity is its plus, it is linked to physics and arts.

Overall, she was very positive about the activity, its progress and outcome.

3. Improvement Suggestions

It is essential that enough time should be given to the introductory activity that will enable the pupils to get a better knowledge of correct terminology to work with in later stages.

Next time the teacher would rather start with the worksheet that helps recapitulation of the needed vocabulary that can be later enriched by more difficult solids and their nets.

The teacher also suggests the lesson plan to be used in two subsequent years, in Grade 7 work with the basic solids, in Grade 8 work with complex solids.