LUCKY NUMBERS

by Marie Hofmannová* and Jarmila Novotná*

INTRODUCTION

The following unit is a part of LOSSTT-IN-MATH project piloted in the CLIL course (Content and Language Integrated Learning, i.e. teaching a non-language subject through the medium of foreign language) at the Faculty of Education of Charles University in Prague (Novotná, Hofmannová, 2000). This two-semester pre-service teacher training course is aimed at students as of the third year of their studies. It is a seminar, 90 minutes per week, with many activities run in the form of workshop.

The course is led by two trainers, one specialised in mathematics education, the other in methodology of teaching English. During the LOSSTT-IN-MATH piloting experiments, the CLIL course was attended by fifteen trainees.

The course was originally designed for teacher training of prospective teachers of mathematics and English language. It is conducted in English. Regardless of this fact, also students – prospective teachers of other non-language subjects and foreign languages participate. This feature enriches the course in the multilingual perspective. The course combines educational theory and teaching practice, bringing students gradually from lesson observation, mastering subject specific vocabulary and CLIL specific knowledge and skills. This is followed by microteaching of peers based on a variety of materials (e.g. textbooks, student-made worksheets) and concluded by a teaching module in real school conditions.

Mathematical content covers mathematics for lower and upper secondary levels and reflects both mathematics taught in public system of education in the Czech Republic as well as some aspects of the bilingual experiment carried out in selected upper secondary schools. From the language perspective, the aim of implementing CLIL is to provide pupils with more exposure. What CLIL offers to learners of any age, is a natural situation for language development which builds on other forms of learning.

For the purposes of piloting LOSSTT-IN-MATH proposals, we selected such units that seemed to be compatible with our course content. The activity Lucky Numbers was included in the set of investigative activities proposed by Western Australian Mathematical Association and later modified to combine mathematics and foreign language teaching.

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Main piloting

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ORIGINAL TEXT

"Choose a number. Square each of its digits and add the squares to get a second number. Square the digits of the second number and add the squares to get the third number. Continue this way to get a sequence. If the sequence reaches 1, the original number is called lucky. If not, it is called unlucky."

1. Mathematical topics for development

Arithmetic and application of algorithms

2. Aims

***For trainers*:**

- Guiding the trainees from theory to practice
- Making the trainees develop a lesson based on a problem taken from a mathematics textbook
- Providing instructions and feedback

***For trainees*:**

- Investigating solving/learning strategies
- Developing a lesson plan
- Preparing own teaching material
- Peer teaching
- Classroom teaching

***For secondary school pupils*:**

- Experiencing the teaching of mathematical content through the medium of English language
- Making problem solving more effective by discovering regularities
- Practising skills of addition and multiplication of natural numbers

3. Description of the activity

The training activities were planned in five stages, i.e. five weeks. Stages 1, 2, 3 and 5 were carried out during the CLIL course (45-minute sessions), stage 4 in the secondary school (a 45-minute lesson).

Stage 1 The trainees

- solve the problem and compare different solving procedures,
- discuss the necessary knowledge and skills for each solution (from the learners' perspective in both mathematics and English as a foreign language).

- Homework for stage 2: the trainees prepare the first draft of a lesson plan (for team/peer teaching).

Stage 2 The trainees

- teach one phase of their lesson plan (team/peer teaching),
- analyse the teaching attempts,
- suggest changes and select the best ideas for the final draft of the lesson plan.
- Homework for stage 3: Group work – group 1 prepares the final draft of the lesson plan, groups 2 and 3 prepare the necessary teaching materials and aids.

Stage 3 The trainers

- check and discuss the final draft of the lesson plan and the teaching materials and aids with the trainees,
- together with the trainees they select two student-teachers who will teach the lesson in a real classroom.

Stage 4 At the secondary school

- the two student-teachers teach the 45 minute lesson. The remaining trainees and the trainers observe, take notes and video-record the lesson.

After the class:

- the student-teachers get immediate feedback from the learners (about 5 minutes),
- together with the other trainees and the trainers they discuss the course of the lesson (about 10 minutes).

Stage 5 The trainees and the trainers

- watch the video-recording,
- reflect on the teaching experiment.

The trainers

- evaluate and assess the student teachers using the material for student-teacher evaluation and assessment during the teaching practice.

4. Assignments

a) Assignments for teacher trainees

- What prior knowledge is required for solving the task?
- Consider different starting numbers. What different stages do the sequences eventually reach? How many different stages are there?
- Look for ways of using one sequence to complete the others.
- Try drawing a diagram to show how numbers are related.
- Can you predict in advance any number that will be lucky/unlucky?

- What sorts of numbers produce sequences that are identical except for the first number?
- Try some three and four digit numbers.
- What proportion of the numbers for 1 to 50 is lucky/unlucky?
- Are lucky numbers more often odd than even?
- Investigate adding the cubes of the digits of numbers.
- Consider the previous mathematical tasks from the teacher's point of view.
- Discuss the first and third part of the proposal: What is the optimum student grouping?
- Would you extend teacher talk? How?
- What is the proportion between student and teacher work?
- What is the optimum timing for this activity? State variables.
- Consider task management aspects from the learners' perspective, e.g. systematicity, the proportion of oral/written work, division of roles.
- Mathematics taught through a foreign language: Write a translation of the assignment.

b) *Assignments for the pupils* (*presentation of the context*)

- Make a list of numbers considered by your family and friends as lucky numbers stating a variety of reasons.
- Results of our investigations show that different numbers are considered lucky for different people. Somebody's lucky number might be unlucky for somebody else.
- This, however, should not happen in mathematics. Let us define the lucky number as follows: "Choose a number. Square each of its digits and add the squares to get a second number. Square the digits of the second number and add the squares to get the third number. Continue this way to get a sequence. If the sequence reaches 1, the original number is called lucky. If not, it is called unlucky".
- Find all lucky numbers from 1 to 99.

5. Piloting

a) *In the training course*

A priori analysis of the text

- Discussing possible mathematical solutions.
- Anticipating methodology problems.

Preparing the lesson [*this stage was video recorded by one of the trainers*]

- The trainers and trainees discuss in Czech how to best prepare the microteaching of peers. They assign roles and prepare the first draft of lesson plan.

- Peer-team teaching in English: One stage of the proposed lesson is taught by two student teachers, the remaining trainees play the roles of pupils. One trainer takes notes on the blackboard for further discussion.

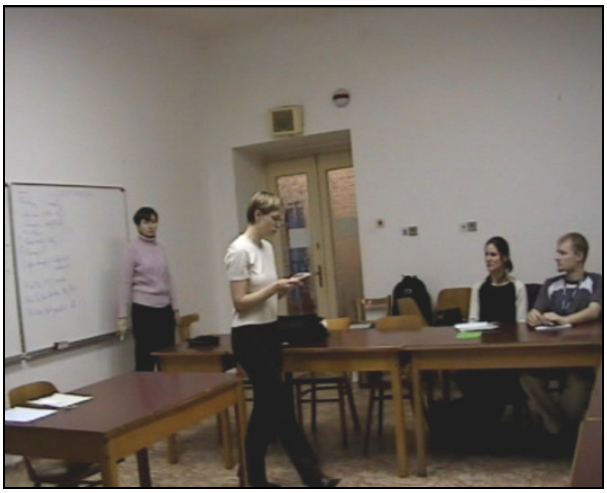

Photo 1. Peer teaching

- Trainers and trainees analyse the teaching attempts in English based on the notes on the blackboard. Comments and suggestions for the real classroom are proposed. The aim of the lesson is set for both mathematics and English.
- Mathematics – solving strategies.
- English as a foreign language – mathematical talk.
- Trainees divide into groups and decide who will prepare the final draft of the lesson plan and who will work on preparing the teaching materials (e.g. pictures, glossary of words) and they discuss the necessary aids.

b) *In the classroom*

The town of Kladno, lower secondary school, optional lesson, 8 pupils, 15 years of age, the classroom teacher, one of the teacher trainers, 45 minutes.

Teaching the lesson [*this stage was video recorded by one of the trainers*]

- The staffroom: Checking the lesson plan, materials, and aids.

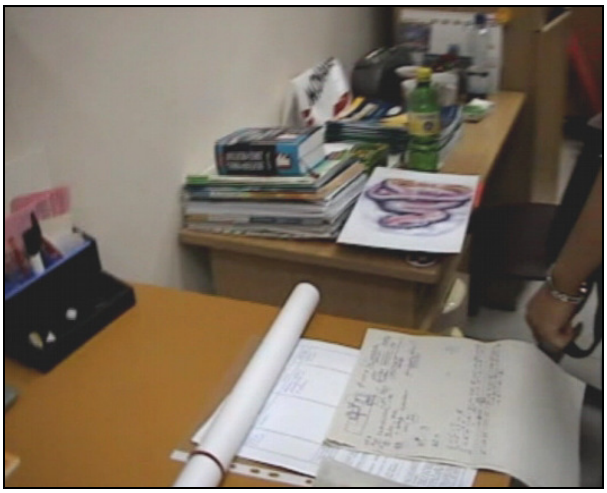

Photo 2. In the staffroom

- The classroom:
  - Introduction: The teacher motivates the pupils in English: good luck vs. bad luck.
  - The teacher presents visuals – six pictures. Pupils are asked to describe, the teacher elicits responses from pupils.

Photo 3. Using visuals

  - More information from pupils, unrelated to pictures, the teacher writes on the blackboard: lucky/unlucky numbers.
  - The teacher presents a problem: Is her date of birth a lucky or an unlucky number?
  - Listening comprehension: The teacher tells a story about a kingdom – lucky numbers.

Photo 4. Telling a story

  - The teacher introduces simple mathematical language in English.
  - Introduction of the procedure using 2 as the starting number (see Photo 5).

Photo 5. Switching into mathematics
(Example: 2 → 4 → 16 → 37 → 58 → 89 → 145 → 42 → 20 → 4)

- Controlled practice: The pupils and the teacher write on the blackboard. (A similar problem: February, i.e. 2nd month, is it lucky or unlucky?)
- Free practice: The pupils carry out an individual pen and paper activity. The problem: "You proposed certain numbers as lucky for your families and friends. Will they remain lucky if you apply our procedure?" Feedback: Two pupils write on the blackboard.
- Further practice: individual work. The teacher poses the following problem: Is your date of birth a lucky or unlucky number?
- Revision of vocabulary in English: months. Further investigation linking to the mathematical topic: Is the pupils' month of birth a lucky or unlucky number? The teacher elicits feedback: Individual pupils come to the front, write on the blackboard, and report back to the class.
- The teacher summarizes the class with the pupils using the table of numbers on the blackboard.

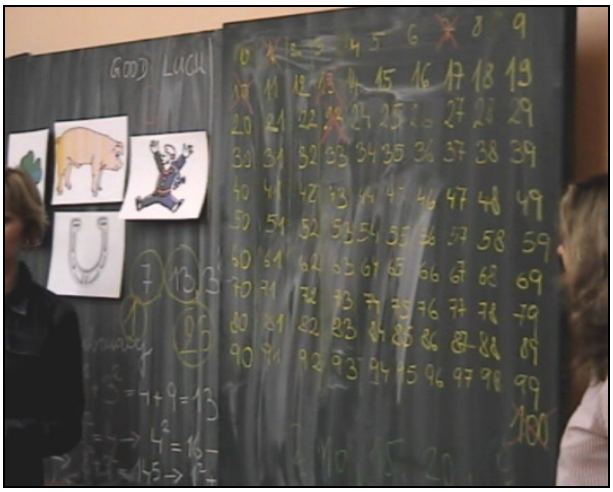

Photo 6. Table for the summary of results

- The teacher concludes the lesson.

c) *In the training course*

A posteriori analysis – reflecting on the lesson [*this stage was also video recorded by the trainer*].

The discussion was conducted in English and was fairly free. The items discussed were:

- lesson analysis
- comments
- critical remarks
- suggestions for alternatives.

During the discussion, the class spontaneously switched into Czech because both parties found it easier to express their feelings about the lesson in the mother tongue.

It was concluded that the experiment was the real success. Following to that, as a final point of discussion, one of the trainees decided to use the same materials and the lesson plan in order to carry out the lesson in a different secondary school through a different foreign language – Spanish. Her teaching attempt was also video recorded, this time by one of the trainees.

6. Concluding remarks

Comparing and contrasting the two video recordings enabled to make the trainees aware of the following facts:

- The personality of the teacher plays an important role because the lesson based on the same lesson plan with the same teaching materials might develop in a different way due to the different teaching style.
- Team teaching is advantageous for both the teachers and the pupils.
- Different foreign language of instruction did not constitute any obstacle to learning.

SUGGESTED READING

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