

TRAVELLER'S DIARY

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**Abstract**

A new application of interactive bulletin board, Traveller's Diary, was introduced with its definitions, material design and its compatibility with NCTM and MONE objectives. Traveller's Diary was intended to be an enjoyable activity encapsulating mathematical processes that were relevant to real-word problems. When strengthened with the feedback from the teachers and students at BLIS, Traveller's Diary might serve as a promising tool for both course engagement and evaluation of mathematical understanding.

*Key Words:* Interactive bulletin board, mathematical material design, mathematics activity.

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## **Introduction**

Interactive Bulletin Board is a creative teaching concept that enables students to explore their mathematical understanding and curiosity without the continuous presence of a teacher. The main goal of Interactive Bulletin Board is initiating an interest and love for mathematics in a student. Thus, it should often provide interesting features such as game elements, colorful images and materials that grab the attention of students. In this study, a new application of Interactive Bulletin Board, Traveller's Diary, is presented and investigated to identify whether the goals of an Interactive Bulletin Board are reached.

## **Interactive Bulletin Board Details**

**Title:** Traveller's Diary

**Grade level:** 7-8-9

**Objective(s) (learner outcomes):**

- Students will recognize the tape measure and perform accurate length measurement between two given points.
- Students will apply their knowledge of ratio into map scaling and convert units of length.
- Students will practice multiplication and division of decimals.
- Students will practice ratios and proportions by solving problems including distance, speed, time and cost.
- Students will recognize the map of Europe, flags of European countries and important cities. (Geography)

**NCTM content and process standards:** Students should be able to

- work flexibly with fractions, decimals, and percents to solve problems;
- understand and use ratios and proportions to represent quantitative relationships;

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- understand the meaning and effects of arithmetic operations with fractions, decimals, and integers;
- select appropriate methods and tools for computing with fractions and decimals from among mental computation, estimation, calculators or computers, and paper and pencil, depending on the situation, and apply the selected methods;
- understand relationships among units and convert from one unit to another within the same system;
- solve problems involving scale factors, using ratio and proportion. (NCTM, 2000)

### **MONE Objectives:**

- 5.2.3.1. Uzunluk ölçme birimlerini tanır; metre-kilometre, metre-santimetre-milimetre birimlerini birbirine dönüştürür ve ilgili problemleri çözer.
- 6.1.5.8. Ondalık ifadelerle dört işlem yapmayı gerektiren problemleri çözer.
- 6.1.6.3. Aynı veya farklı birimlerdeki iki çokluğun birbirine oranını belirler. Örneğin, 3 saatte 150 km giden bir aracın aldığı yolun geçen süreye oranı  $150 \text{ km} / 3 \text{ sa} = 50 \text{ km/sa}$  olarak yazıldığından bu oran birimlidir.
- 7.1.4.1. Birbirine oranı verilen iki çokluktan biri verildiğinde diğerini bulur. Günlük yaşam durumlarına ilişkin örnekler üzerinde çalışmalar yapılır. Örneğin, 24 TL'ye 3 kg deterjan alınabiliyorsa 1 kg deterjanın 8 TL'ye alınması
- TD.11.3.2. Yüzde, oran ve orantı kavramlarını günlük hayatta karşılaştığı durumların analizinde ve problem çözme sürecinde kullanır.
- TD.11.3.4. Seyahatlerde mümkün olan alternatifleri karşılaştırır. (MoNE, 2013)

### **Materials used:**

- A white cardboard (70x50 cm),

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- A tape measure and its container,
- Empty map of Europe (50x40 cm),
- Colourful pencils to draw flags,
- Pen for writing the city names,
- Magnet photos of some cities,
- Glue,
- Colourful Scotch tape,
- Colourful paper (for the title),
- A big paper envelope and four small paper envelopes,
- A plastic transparent envelope,
- White paper for diaries, city names and answer key,
- A small transparent pouch,
- A thumbtack,
- Magnets as gifts to students.

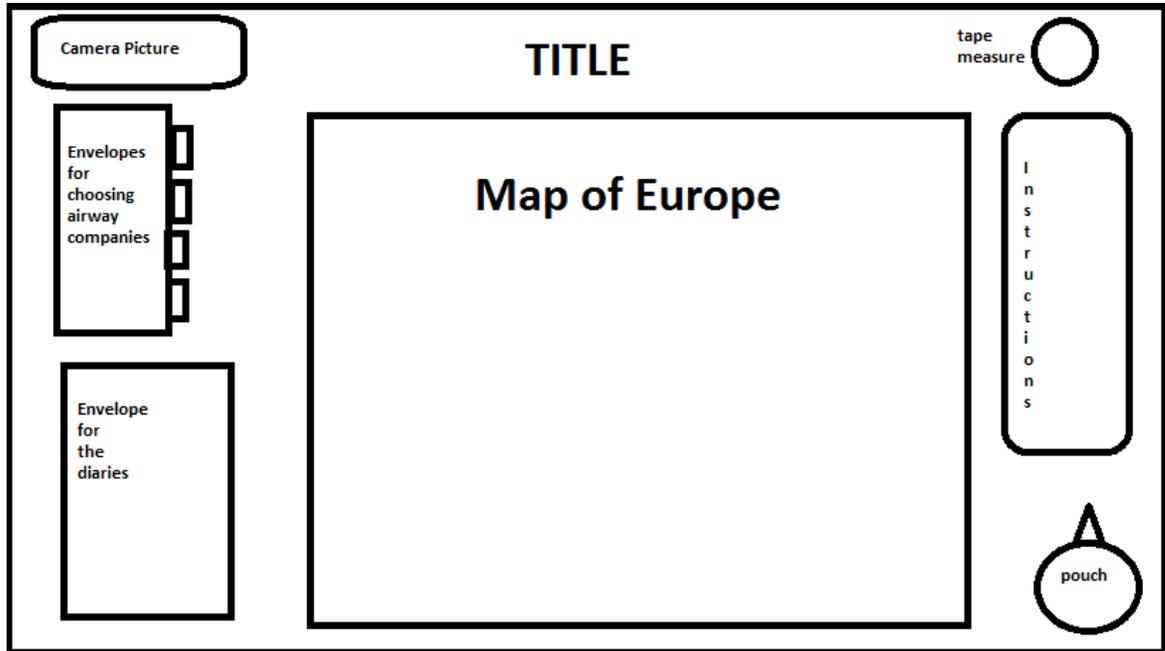


Figure 1. Conceptual drawing of the interactive bulletin board.

**Description of the interactive bulletin board activities and problems:**

*The traveller* (interacting student) chooses two cities from the pouch, in order to determine the departure and arrival points of their journeys. There are 42 cities marked on the map. Therefore, there are totally  $C(42, 2) = 861$  different combinations that a traveller could choose. The travellers will make plane trips between the two selected cities. Assuming that there won't be any flights between the cities that are less than 200 km to each other, it is said in the instructions that: *"If the two cities you selected are in the same country, or they are less than 2 cm to each other on the map, then please change the destination"*. Hence, the actual number of combinations will be less than 861.

The student takes an empty diary from the plastic envelope and starts to fill in. First, they write their name, the date and the names of the selected cities. Then, they measure the distance between two cities and note it on their diary. A sample diary to be filled can be seen in Figure 1.

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<p><b>TRAVELLER'S DIARY</b></p> <p>DATE: ...05.../...12...../.....2013.....</p> <p>I have travelled from .....Sofia..... to .....Dublin..... .</p> <p>I measured the distance as ... 26.6... cm between the two cities on the map.</p> <p>It corresponded to .....2660..... km real distance.</p> <p>Therefore, the round trip was .....5320..... km long.</p> <p>I travelled with ..... Airways.</p> <p>My total travelling time was ..... hours.</p> <p>It cost me ..... euros.</p> <p>NAME: ..... James Erkmen .....</p>
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Figure 2. A sample diary

The scale information of the map is given as follows: “*The scale of the map is estimated to 1/10,000,000, i.e. 1/10<sup>7</sup>, i.e. 1 cm on the map represents approximately 100 km of real distance*”. The student finds total distance in a round trip and note it on his/her diary. After finding the real distance, the student chooses an airway company from the four blue envelopes. This quadruples the total number of possible outcomes in the bulletin board. The planes are assumed to fly at different altitudes according to their power, hence it was said that their speeds might differ consequently. The airway companies are given the names of Fermat, Banach, Bernoulli and Maxwell, so that the students are expected to recognize those mathematicians.

FERMAT AIRWAYS	
Average Speed of planes	500 km /h
Average Price	0.7 € /km

BANACH AIRWAYS	
Average Speed of planes	600 km/h
Average Price	0.8 € /km

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<b>BERNOULLI AIRWAYS</b>	
Average Speed of planes	400 km/h
Average Price	0.5 € /km

<b>MAXWELL AIRWAYS</b>	
Average Speed of planes	300 km/h
Average Price	0.5 € /km

*Figure 3.* Possible tariffs in the envelopes.

According to the selected tariff, the student is expected to calculate the total travelling time and the total cost of the journey. They are expected to round their answers to two decimals whenever necessary.

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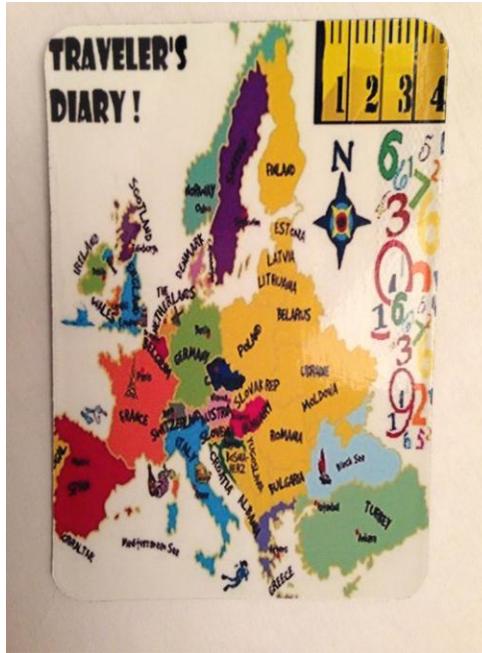
Figure 4. A picture of the Traveller's Diary

A table is prepared as an answer checklist for all alternative initial measurements using MS Excel. The minimum measured distance on the map is assumed to be 2 cm and the maximum is estimated to be 42.5 cm which is the distance between Lisbon and Moscow. The checklist was printed and used to check the answers. The checklist can be seen in the following excel document.



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I had a surprise gift for the students who had all their answers correct according to the checklist. I designed a souvenir for them and ordered some 6x9 cm prints from the internet. The magnets that I received had plastic coated cover with magnetic back. A picture of the gift magnets can be seen in Figure 5.



*Figure 5.* A picture of the gift magnet.

### **Students' interaction with the IBB:**

I had a chance to carry out this work for a short time in an 8th grade class in BLIS. The students chose their cities and filled in their diaries. They examined the tape measure for some time.

First of all, I have observed that some of the students had problems in understanding and formulating the problem. They needed more explanation for making a sense of what is going to be done. Some of them were not clear about proportional relations and ratios of units. In order to sort out this stage, I performed an example for them.

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Moreover, I observed them while they were doing their computations. One of the students had some problems in multiplication of decimals. She had to multiply 0.8 by 5200 to find the total cost of her journey. She tried to do a long multiplication, but she was confused and found the result as 0.416. Her first initiation of multiplication can be seen in Figure 6.

$$\begin{array}{r} 5200 \\ \times 0.8 \\ \hline 41600 \\ + 00000 \\ \hline 0.41600 \end{array}$$

*Figure 6.* Incorrect multiplication operation of decimals by a student

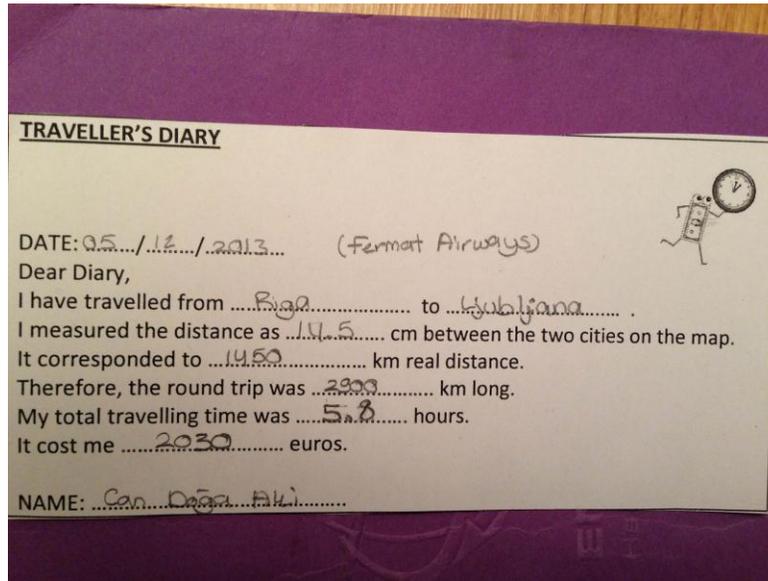
Then another student, who had completed the activity in a very short time before her, advised her to multiply 8 by 520, instead of multiplying 0.8 by 5200. With this method, she was able to reach the right solution.



*Figure 7.* Me and the students dealing with the IBB.

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Although the activity was difficult for some of the students, some others filled in their diaries in a very short time by mental computation. That's why it can be said that the content age level was appropriate. A good example of the diaries can be seen in Figure 8.



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DATE: 05/12/2013 (Fermat Airways)

Dear Diary,

I have travelled from Rijeka to Hurljuna .

I measured the distance as 14.5 cm between the two cities on the map.

It corresponded to 14.5 km real distance.

Therefore, the round trip was 290 km long.

My total travelling time was 5.8 hours.

It cost me 2030 euros.

NAME: Can Doğa Akı

Figure 8. Doğa's diary.

The activity took the attention of girls more than boys. But in the overall, I cannot say that the students showed an extreme interest to the activity. According to me, this has two main reasons. The first one is that it did not include a “*competition element*”, since I told them that it was a single-person activity. One way to overcome this issue might be making it a 2-person game and adding a time constraint.

The second reason might be the grade level. Students in this age group (8th graders) are in the early adolescence stage of their development. They explore their independence and develop a sense of self in this period. Therefore, some of them might think that they are too cool for these type of activities. Some others might feel the tension of failure and step aside.

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When I showed the IBB to the mentors, they liked it very much. Ms. Paola San Martini told that she loved the idea since it included multiple mathematical topics and an international context. She appreciated the answer key as well. Ms. Gonca Tüker said that it was a nice activity that provides coherent concepts in depth. She said that it would assist a wide range of grade levels. She had suggestions to make it shorter sometimes by using only the scale aspect or only the distance-time relation. She advised to keep time for the students' work as a motivator element for them.

### **Conclusion**

An interactive bulletin board, which aimed to increase mathematical understanding and trigger curiosity against real-world mathematical needs, was investigated in this article. With this experience, I learned that social behavior of the students and grade level should be well evaluated before presenting such an activity to the class, in order to achieve a more competitive and socially interesting, game-like exercise. According to the feedback from students and teachers at BLIS, the learning environment at the time of interaction can be highly varying. Multiple mathematical aspects from Traveller's Diary can be picked and adapted for different class levels and limited environments.

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