

## WORLD (World Bank Random Linked Data)

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**Abstract.** World Organizations all around provide access to variety sets of different data listing available datasets, tables, reports, and other resources making it available for the wider audience. A smart interface is needed to use, combine and present relevant information that will provide the best usability of the opened data. Developing a single solution that will work across different sectors using the opened data from those World Organizations will have a great impact on different sectors in the future, especially in education. Our solution WORLD (WORLD RANDOM LINKED DATA) that was awarded by the World Bank in 2011 is a cross-sector prototype of a web based service which provides information using the open data of the World Bank and generates random information in the form of sentences with a combination of pictures, videos and maps. Using the World Bank database as well as the United Nations Human Development Index, the service generates intelligent and relevant information, adapting to different sectors, like education, agriculture, poverty, etc. The current solution was tested among the students in one of its practical implementation of this web service: the Moodle e-learning system. It is a Moodle block that uses the data from the web service from areas that are within the scope of Millennium Development Goals. Analyzing the negative and positive aspects of the WORLD Block we've come to the conclusion that this solution presents a good approach for displaying a lot of new information from different areas of interest in a small section. Further development will include refining of the structure in the Block, expanding the media types of generated data from the web service like games, flash, custom maps etc. The final goal is to make a generator of intelligent information that will: personalize the information, a service fully adaptable to different sectors, provide valuable information and positive user experience, be used by any web application and provide efficiency and effectiveness in gathering and presenting the information using the open databases.

**Keywords:** open data, web service, web interactivity, World Bank open data

## 1 Introduction

World Organizations all around the world provide free access to a variety of data organized in datasets, tables, reports, and other resources making it available for the wider audience. Designing and developing a smart interface which combines and presents relevant information providing the best usability of the opened data is strongly needed. Single solution that will work across different sectors using the opened data from those World Organizations will have a great impact on different sectors in the future, especially in education.

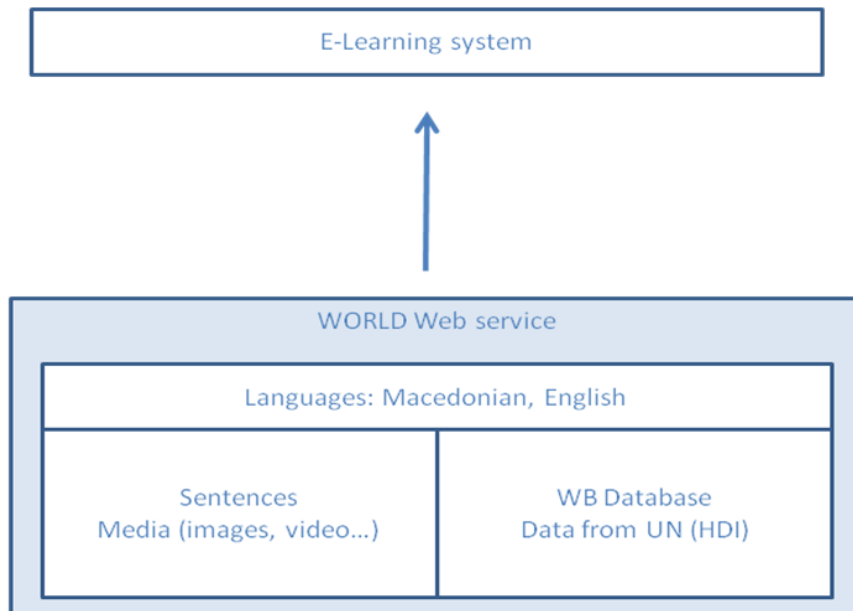
The purpose of this paper is to present our solution WORLD and the results we obtained through testing and analysis on the solution. WORLD (WORLD RANDOM LINKED DATA) is a cross-sector prototype of a web based service which provides intelligent information using the open data of World Bank and generates random information in the form of sentences with a combination of pictures, videos and maps. Using the World Bank database as well as the United Nations Human Development Index, the service generates intelligent and relevant information as a step towards reaching the Millennium Development Goals and is adaptable to different sectors where these data can be implemented. It could be applied in education (which is now a case), in water supplies, in poverty issues, in state economies, in other words with some adjustments, actually in every field where the world organizations have their accurate and unique data. We designed this solution in order to be more accessible and available for the wider public and to be used by any application on the web like various e-learning systems, Non-Governmental Web sites, Facebook applications and many others.

## 2 Project architecture

The project contains the following parts:

- Web service
- Database
- Public web site
- Moodle block

Our web service is based on .NET technology and it is written in C# programming language. It has only one web method, called “worldservice”. This method takes six parameters from a query string as an input, and, depending on the input, it returns an XML file as a response. The six input variables are: language, field (area of interest, example: education), country (data for desired country, or all countries), media (media type, images, video) and resolution (width and height). Depending on the resolution, the web service generates appropriate videos and images.



**Figure1.** Current architecture of the project

These parameters define the type and the content of the information that will be generated by the web service. Depending on these input parameters the web service checks what's needed to be extracted from the database and determines the display language, the area of interest, the targeted country, the type of media and resolution (there are two optional parameters, "width" and "height" and they are used to define the desired resolution of the image or video). According to the type of media, the web service always generates a sentence. At this point, the web service user can choose what other type of media to be represented (picture, video or map). Then a connection to the database is made and the proper data is extracted. After all this, the service puts the random generated data in proper tags in XML format that is being returned as a response.

For example, if we want to display information in the field of education, for all countries, in English, and the desired media is text, we send the following query string request to the web service:

```
http://world.fon.edu.mk/world.asmx/worldservice?ln=en&field=1&cnt=0&media=0&width=0&height=0
```

The service reads the input data and returns a XML response in the following format:

```
<?xml version="1.0" encoding="utf-8"?>
<world xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns="http://world.fon.edu.mk">
<ti-
tle>&lt;ahref='http://world.fon.edu.mk'&gt;WORLD&lt;/a&gt
;</title>
<content>&lt;p&gt;The youth literacy rate for the male
population in West Bank and Gaza, in the year 2006, was
99,053%. In comparison, the youth males literacy rate in
the year 2007, was 99,147 %.<content>
<footer>&lt;hr /&gt;&lt;p style='font-size:10px;line-
height:12px'&gt;The service has been called 153 times
from this site. Find more information &lt;a
href='http://world.fon.edu.mk'&gt;here&lt;/a&gt;.&lt;/p&g
t;</footer> </world>
```

### 3 Moodle Block

Practical implementation of this web service we have seen in the possibility this content to be displayed on the most used e-learning system in the world - Moodle .

This system is used by 50.000 universities around the world, with currently 37 million subscribed users. The idea is implementation of Moodle block that contains data from our web services from areas that are within the scope of MDG (Millennium Development Goals). The block in the background calls our web service which returns content that is displayed in the block. The institutions which have this e-learning system installed are able to install and use our block by choosing different service parameters. Then, on their home (or course) page is shown random content and data from the database of the World Bank, which is generated by our web service. These data inform the (mostly) students and other users of the system about the current situation of these areas, showing data in form of sentences, images or video, depending on the choice of the institution.

### 4 Experiment

The current status of our solution was tested at the Laboratory for Human Computer Interaction and Inclusive Design at Cyprus University of Technology as part of a Short Term Scientific Mission through the COST Project in one of its practical implementations: the Moodle e-learning system. Throughout this experiment two objectives were taken into consideration. The first objective was testing the location of the WORLD Block in a Moodle course. The results showed where the Block drew most attention of the users regarding the type of information displayed and which location

should be considered as a best possible location for displaying the WORLD Block. The second objective was to test the usability and learnability of the structure of the information provided in the Block. The results showed the participants attitudes about the Block and their negative and positive impressions about it.

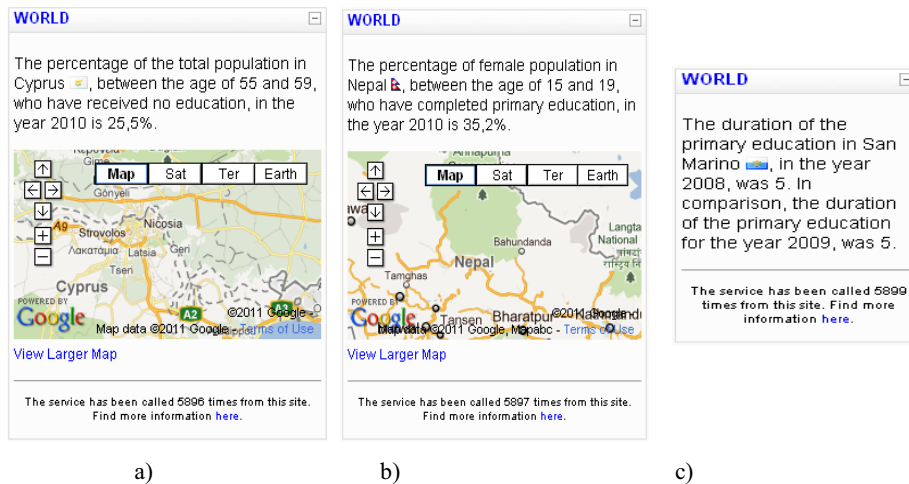
The screenshot shows a Moodle course interface for 'Education in Cyprus'. The page is titled 'Education in Cyprus' and indicates the user is using guest access. The sidebar on the left contains sections for 'Activities' (Forums, Lessons, Resources), 'Search Forums' (with a search box and 'Go' button), 'Administration' (Enrol me in this course), and 'Courses' (Education in Cyprus, World Education, Education in the world). The main content area features a 'Topic outline' with a 'News forum' and two items: '1 Materials' (with a 'Picture 1' icon) and '2 Assignment'. On the right side, a 'WORLD' block is highlighted with a red border. This block contains the text: 'The duration of the primary education in Cyprus in the year 2006, was 6. In comparison, the duration of the primary education for the year 2009, was 6.' Below the text is a map of Cyprus with labels for Nicosia, Strovolos, Akrotirio, Latsia, Geri, and Tsiri. The map includes a 'Map' button and a 'View Larger Map' link. At the bottom of the block, it states: 'The service has been called 5900 times from this site. Find more information here.'

**Figure2.** Example of using a WORLD Block in a Moodle course  
(The WORLD Block is outlined with a red color)

This experiment was structured to have several steps. First, three Moodle courses were created in the Moodle e-learning system. In all three the WORLD Block was installed in the right hand side section of the course screen. The WORLD Block displayed information related to education. We set up different features for the WORLD Block on every course. The first course was named Education in Cyprus. In this course our Block was set up to display information related to Cyprus education in a form of sentences and/or maps according to the type of the sentence. In the second course named WORLD Education the WORLD Block was displaying information for all world countries in the form of sentences and/or maps. And, in the third course information for all countries in the world were presented in a form of sentences without any media types.

The next step was setting up an experiment with the eye tracker (a RED 500 SMI eye tracker). For that purpose the Experiment Center TM 2.5 was used. This software program enabled to prepare and execute gaze tracking experiments. It is complemented by SMI iView XTM for gaze tracking data acquisition and SMI BeGazeTM 2.5 for gaze tracking data analysis. Experiment Center TM 2.5 was running on a SMI laptop

and was connected to the iView X system. The iView X system in turn operated an attached gaze tracking device.



**Figure3.** WORLD Block in the course: a) Education in Cyprus, b) World Education, c) Education in the world

The experiment was conducted with twelve test subjects whose gaze positions and actions were monitored. At the beginning of every session we entered ID information for every participant and verified the calibration necessary to adapt the iView X eye tracking software to the participant's eye characteristics. Then, every participant entered one of the Moodle courses with a quest account. About 15 seconds the test subjects were not instructed with any command. Then after that time period, every participant was instructed to focus on the right hand side section of the website where the WORLD Block was installed. After reading the information in the WORLD Block the participants were asked to do an assignment in the course. The assignment consisted of answering a question related to the information that was presented in the WORLD Block. Every course was visited individually by 4 participants. In addition, as a further contribution to the subject, the participants were asked to fill a questionnaire. The main goal behind designing a questionnaire was providing an easy way for analyzing the attitude that the participants had about this Block.

## 5 Methods used for the analysis

After finishing the experiment, the phase of analyzing results begun. In order to see all the negative and positive aspects of this solution, we used three different methods for analysis: gaze tracking analysis, moodle block analysis and questionnaire analysis. To analyze gaze tracking data we used SMI BeGazeTM 2.5 software. SMI Be-

GazeTM 2.5. is a behavioral and gaze analysis software for eye tracking data. It displays, analyses and visualizes various kind of stimuli (pictures, web pages etc.) with integrated filter functions that allow analyzing subgroups of participants. It provides full spectrum of visualizations like:

- Gaze plots (scan path, bee swarm, gaze replay)
- Attention maps (focus map, heat map)
- Real time statistics (key performance indicators, gridded AOIs)

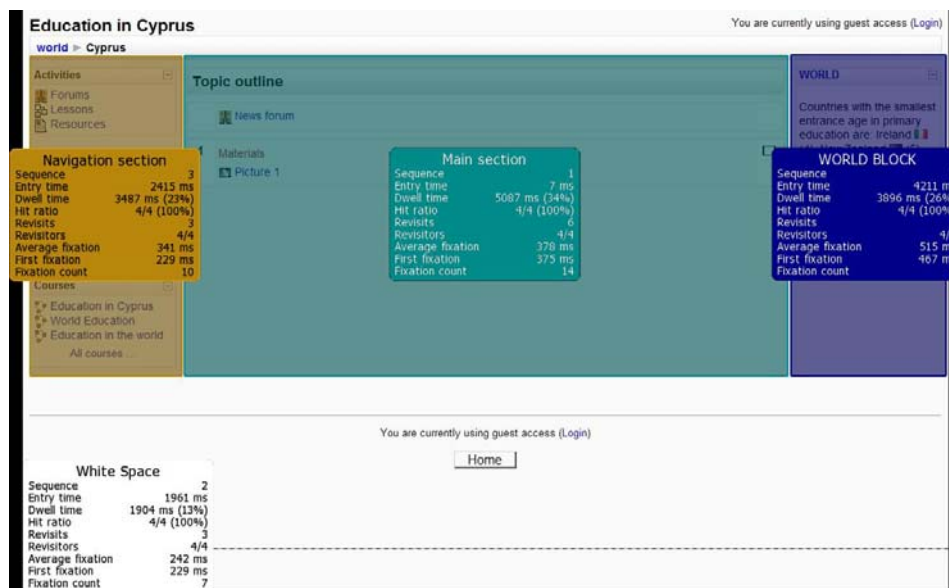
These are powerful methods for analyses. For better analysis, we divided every course in three areas of interest. The first one was the Navigation section in the left hand side of the course that helps users to navigate through the moodle e-learning system. The second was the Main section in the middle of the course where you can find the lectures, assignments and materials for the students. And the third section was the WORLD Block positioned on the right hand side of the course. For analyzing the assignment in the Moodle course the Reports section in the Moodle e-learning system was used where a detailed statistics for every user answer was made. Using a Google document form for the questionnaire analysis provided us with a good structure for analyzing the participants' attitude. We've created the questionnaire as a Google document for its simple and effective structure. The structure of the questionnaire was organized as follows: two required text questions, followed by twelve scaled questions (from 1 to 7) and two text questions that weren't required. The aim of the scaled questions was to determine respondents' attitudes about the features of the WORLD Block. If they really liked some of the WORLD Block features they selected maximum - 7 and if they disliked some of the features they selected 1.

## 6 Results

A large volume of data was collected during the experiment regarding several aspects of the WORLD Block. The experiment went as expected, without error or losing data. The results were divided into three main parts according to the methods used for analysis. In the first part we displayed the results from the gaze tracking analysis. In this part, the results for each course were split into two time intervals. The first interval was when the participants were not instructed to do anything in the course and the second interval was when the participants were instructed to read and look into the information presented in the WORLD Block. Every participant saw different information in the Block, because the Block displays new information every time a course is visited.

The second part represented the results from the assignment the participants made in the Moodle course and the third section presented the results from the questionnaire. In this section we will present only the summary of the overall results for the three different courses that the participants visited without any further details.

Comparing the overall results in all courses we've noticed that the WORLD Block section is the second area of interest. Also, we noticed that in the course World Education there was lower visual activity in the WORLD Block section comparing to the other courses: Education in Cyprus and Education in the world where the results indicated a bigger level of visual activity in the first interval of participants' sessions.



**Figure 4.** Key Performance Indicator of all participants that visited the course Education in Cyprus in the first interval of their session

Analyzing several important statistical indicators associated to each Area of Interest (AOI) in the first interval when the participants were not instructed to do anything in the course enabled a sound comparison of different statistical information for the WORLD Block in the three different courses. According to the entrance time, which represents the average duration for first fixation into specific AOI, the course WORLD Education (3192 ms) had best result in this section in the first interval, followed by Education in Cyprus (4211 ms). Education in the world had the biggest value for entrance time - 4472 ms, which meant participants needed a longer time for noticing the Block in the first interval of their sessions. According to the Dwell Time, which represents the sum of all fixations and saccades within an AOI for the selected participants divided by the number of selected participants, the course Education in the world had biggest percentage for the WORLD Block section - 31%, followed by WORLD Education - 29% and Education in Cyprus - 26%. And about the information for HIT Ratio (how many participants of the selected looked at least one time into a specific AIO) and revisit, the course Education in Cyprus had the best results. In the course mentioned above, every participant took a look into the Block and every



participant revisited our Block. Unlike this, the course World Education had the worse results with only 75% hit ration and two of three revisions in this section.

The results from the assignment that the participants performed showed which media types drew attention and distraction when reading the information in the Block. The results were divided in three tables according to the course that the participants visited. And the results from the questionnaire showed the attitude of the participants, and their negative and positive aspects of the WORLD Block.

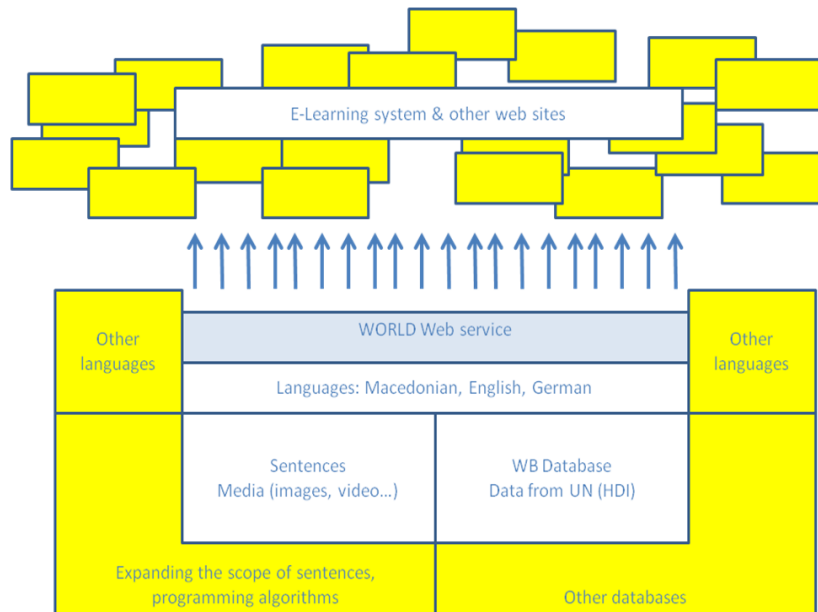
## 7 Discussion and Conclusions

During the experiment a large volume of data was collected. The results were displayed and discussed in the previous section in three different parts. Analyzing the results from the Gaze Tracking we've seen that information with included multimedia types like flags, maps attract more attention than the information displayed only in a form of sentence. Expanding the media type of generated data from the web service i.e. games, flash, custom maps etc should be one of the next steps that need to be taken in improving this solution.

From the findings, we concluded that the location of the Block in the right hand side of the Moodle course is the appropriate place where the WORLD Block should be installed. Analyzing the other results, we've noticed that users are attracted by the flags and the maps of the countries displayed in the Block. The combination of a name of the country and the appropriate flag makes a really good impression for the users.

Analyzing the results from the questionnaire we've recognized that the users feel the potential of the WORLD Block and its possible implementation. Learning a lot of new information through a small area of the WORLD Block is the reason because most of the students assess the Block positively, believing that the Block would save them time.

Through analyzing the negative and positive aspects of the WORLD Block we've come to the conclusion that this solution presents a good approach for displaying a lot of new information from different areas of interest in a small section, but we should continue working on the structure on the Block adding new multimedia types and changing the structure of the sentence displayed, and even maybe changing the structure of the information like listing the information in points instead of using a full sentences. We also need to work on the interactivity with the user, personalization of the block and better design which will include more colors and multimedia information that will draw the users' attention and keep it there.



**Figure5.** Final goal of the project

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