

CIVIC.STAT.MAP - MAPPING DATASETS, VIZ TOOLS, STATISTICAL CONCEPTS AND SOCIAL THEMES

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Teaching statistics using real data with a context and purpose is highly recommended in order to improve multivariable thinking, increase conceptual understanding, and promote statistical literacy. This talk introduces CivicStatMap, a multi-component framework that allows linking of datasets on socially-relevant topics to software tools, to statistical concepts and to socio-economic concepts. The framework is loaded with teaching materials so it is able to display the links between the different components, and enables educators working with different types of learners to choose appropriate ways to achieve educational goals related to analysing and understanding socially-meaningful statistics.

INTRODUCTION

ProCivicStat (www.procivicstat.org/) is a cooperative project of six partners in five countries, funded through the Erasmus+ program of the European Union. ProCivicStat has been developing new methods for statistics instruction for high schools and universities that will contribute to young people's ability to understand quantitative evidence about key social phenomena that permeate civic life. The project offers a platform for continuing cooperation, exchange of ideas, exploration and dissemination of theoretical concepts and concrete teaching materials for promoting civic engagement via exploration of evidence and understanding of statistics about society.

CivicStatMap (<https://rstudio.up.pt/shiny/users/pcs/civicstatmap/>) is a project created by the ProCivicStat group with the aim of facilitating the work of teachers and students to select teaching materials within the scope of Civic Statistics. Civic Statistics are findings about important societal issues involving concepts or ideas not commonly found in introductory statistics courses. But why focus on statistics about society? In fact, data on important societal topics are becoming increasingly accessible to the general public and to individual citizens or social action groups, on a huge range of topics such as migration, employment, social (in)equality, demographic changes, crime, poverty, access to services, energy usage, living conditions, health and nutrition, education, human rights, and many others (Engel, Gal & Ridgway, 2016). One of the main outputs of ProCivicStat is to develop resources (such as lesson plans and teaching materials) for teachers in high-schools and for statistics instructors at tertiary levels, and for their pupils and students, that facilitate exploration and understanding of authentic, multivariate (mostly large scale) data about social, environmental and health issues. CivicStatMap will make life easier for teachers and students since they can select a lesson plan with just one click, being able to select one or several statistical topics, a tool, a social theme, a level of education etc, to have access to all the available teaching material.

DATASETS, VISUALIZATION TOOLS, SOCIAL THEMES AND LESSON PLANS

Among several teaching materials, there are several lesson plans available. Every lesson plan includes questions related to a specific social theme and aims to apply, analyze and interpret statistical concepts such as mean, standard deviation, regression, confidence intervals, time series and other statistical topics using visualization tools. Three levels of education are considered (high school, college and university level), by which the lesson plans were distributed given the difficulty of the concepts under analysis, for each lesson plan.

CivicStatMap helps the user finding the right teaching material, by choosing sequentially the appropriate dataset, visualization tool, social theme and statistical topic. Associated with a dataset there is a visualization tool that makes it possible to maximize the potential of statistical analysis. The most used visualization tools in the lesson plans include iNZight (iNZight, 2017, <https://www.stat.auckland.ac.nz/~wild/iNZight/index.php>), JMP (JMP, 2017), R (R Development Core Team, 2017) and Tableau (Tableau, 2017, <https://www.tableau.com/>).

Regarding social themes, CivicStatMap includes income inequality, natural disasters, refugees, poverty, migration, alcohol consumption, malnutrition, computational skills from PIAAC (Programme for the International Assessment of Adult Competencies), and PISA (Programme for International Student Assessment), among others. The datasets for these and other lesson plans were obtained from Center for Research on Disaster Epidemiology (CRED, 2016, <http://www.cred.be/>), the Armed Conflict Site and Event Data Project (ACLED, 2016, <https://www.acleddata.com/>), at the Center for Disease Control and Prevention (CDC, 2017, <https://www.cdc.gov/>), the World Health Organization (WHO, 2016, <http://www.who.int/en/>), the Organisation for Economic Co-operation and Development (OECD, 2017, <http://www.oecd.org/>), the Institute for Women's Policies Research (IWPR, 2016, <https://iwpr.org/>), the United Nations Children's Fund (UNICEF, 2016, <https://www.unicef.org/>), the World Bank (World Bank, 2015, <http://www.worldbank.org/>), United Nations (UN, 2016, <http://www.un.org/en/index.html>), and many others.

MAPPING THE RESOURCES: CIVICSTATMAP

In order to combine all of the items above, CivicStatMap has been created, under the scoper of the ProCivicStat project. The main objective of CivicStatMap is to provide teachers and students with a faster and more practical way of having access to several teaching materials. For that purpose, they can select social themes, visualization tools, and statistical topics.

Development of CivicStatMap

CivicStatMap is based on a R-Shiny application that was developed in RStudio (<https://shiny.rstudio.com/>). R-Shiny is a R package that makes it easy to build interactive web apps straight from R. With R-Shiny it is possible to host standalone apps on a webpage or embed them in R Markdown documents or build dashboards. In addition, it is also possible to extend Shiny apps with CSS themes, HTML widgets, and JavaScript actions. We started by importing a database into the shiny application, containing the different teaching materials and the different features (datasets, visualization tools, social themes and statistical topics) as attributes. The most part of teaching materials are lesson plans (with a different version for students) corresponding to an education level (high school, the college and the university). The educational level is determined according to the degree of difficulty of the lesson plans. A snapshot of CivicStatMap interface is available in Figure 1.

The screenshot shows the CivicStatMap interface. On the left, there is a sidebar with the title 'CivicStatmap' and a description: 'CivicStatmap is a way of linking ideas, data sources, statistical concepts and visualization tools. Filter you selection and find the appropriate teachers' material'. Below this are filter sections for 'Statistical_Topics', 'Tools', 'Education_Level', and 'Social_Theme', each with a dropdown menu. The 'Statistical_Topics' dropdown is open, showing options like 'Table', 'Relate two or more variables', and 'Mean'. On the right, there is a search bar and a table of results. The table has columns for 'Tools', 'Social_Theme', 'Resource', 'Statistical_Topics', 'Education_Level', and 'Download Datasets'. The table contains 5 rows of data, all with 'Migration' as the social theme and 'University' as the education level.

	Tools	Social_Theme	Resource	Statistical_Topics	Education_Level	Download Datasets
1	Inzight	Migration	Migration - Nigeria	Table	University	Migrants data
2	Inzight	Migration	Migration - Nigeria	Relate two or more variables	University	Migrants data
3	Inzight	Migration	Migration - Nigeria	Mean	University	Migrants data
4	Inzight	Migration	Migration - Nigeria	Quantile	University	Migrants data
5	Inzight	Migration	Migration - Nigeria	Standard deviation	University	Migrants data

Figure 1- CivicStatMap interface

How does CivicStatMap work

On the left side of the screen, users may filter their choices, by statistical topics (filter one or more statistical topics), social theme, level of education, tools and dataset. It is possible to do multiple selections for statistical topics. Moreover, CivicStatMap also contains a search tool for free text search.

The final goal is to retrieve a teachim material. Figure 2 shows an example of what can be found in CivicStatMap: The Migrants lesson plan (teacher version).



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ProCivicStat © - Student's Worksheet, 4.101
Migrants of Nigeria in Europe

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Questions:

These questions contain different ranks of difficulty and listed from the easiest and the most concrete, though the medium level of difficulty, and to the broadest and fuzzy ones that require deep understanding and ability to conclude.

1) What can we say about migrants on the consequence of age?
(Hint: Calculate mean, median, standart deviation, 1st and 3rd quartiles for the variable age and interpret these values in statistical terms.)

2) A journalist argued: "Most immigrants from Nigeria have not even finished high-school". Do you agree with this statement? Explain your answer.
Also, ask yourself if there are more men or women with this type of educational qualification?

Figure 2- Lesson plan of Migrants

FINAL REMARKS

Data on important societal topics are becoming increasingly accessible to the general public and to individual citizens or social action groups, on a huge range of topics. Also, there are more and more sophisticated tools for the teaching and learning of statistics. Students have more interest and facility in learn statistical tools that are easy to handle and that do not require knowledge of programming. In a world of open data, citizens should be able to understand important social and economics concepts as a basis for participation in public decisions. This talk introduces CivicStatMap, a multi-component framework that allows linking of datasets on socially-relevant topics to software tools, to statistical concepts and to socio-economic concepts. CivicStatMap is aimed to be an useful application for teachers and students, since they will have access to teaching materials in a faster and more practical way.

In the future we intend to include in our CivicStatMap the language option for non-English teachers or to be able to access the plans of classes in several different languages. We also intend to update CivicStatMap with new teaching materials.

REFERENCES

- Engel, J., Gal, I., & Ridgway, J. (2016). Promoting Understanding of Statistics about Society. *Preface to the Proceedings: Overview of the IASE Roundtable Conference*, Berlin.
- R Development Core Team. (2017). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. Retrieved from <http://www.R-project.org/>