# Learning experiences with civic data for Global Citizenship[1]

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**ABSTRACT**

This study tracks the evidence of Global Citizenship that reveal the voices of participants when they are immersed in learning experiences related to data science. Civic data, visualization software and the principles of Global Citizenship were used to design learning experiences that embodied some type of global problem (global warming, surface water contamination, carbon dioxide emissions). Learning experiences were implemented with different populations: primary students, secondary students and in-service teachers and each meeting was recorded in audio and video. The meetings were transcribed *verbatim* and over the transcripts were tracked the clues of Global CItizhenship. The results suggest that the verbal statements of the participants offer evidence of Global Citizenship in the cognitive (knowledge), socio-emotional (empaty, responsibility, solidarity) and behavioral (acctions) dimensions as a result of the exposure to the learning experiences.

**KEYWORDS:** Data Science; Global Citizenship; Statistics Teaching; Statistics Learning; Civic Data.

*Experiencias de aprendizaje con datos cívicos para la Ciudadanía Global*

**RESUMEN**

Este estudio rastrea los indicios de Ciudadanía Global que revelan las voces de los participantes cuando están inmersos en experiencias de aprendizaje relacionadas con la ciencia de datos. Se usaron datos cívicos, software de visualización y los principios de la Ciudadanía Global para

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diseñar experiencias de aprendizaje que encarnaban algún tipo de problema global (calentamiento global, contaminación de aguas superficiales, emisiones de dióxido de carbono). Se implementaron las experiencias de aprendizaje con diferentes poblaciones: estudiantes de primaria, estudiantes de secundaria y profesores en ejercicio y se grabó en audio y video cada encuentro. Los encuentros se transcribieron *verbatim* y sobre las transcripciones se rastrearon los indicios de la Ciudadanía Global. Los resultados sugieren que las declaraciones verbales de los participantes ofrecen indicios de Ciudadanía Global en las dimensiones cognitiva (conocimiento), socioemocional (empatía, responsabilidad, solidaridad) y comportamental (acciones transformativas) como resultado de la exposición a las experiencias de aprendizaje.

**PALABRAS-CLAVE:** Ciencia de Datos; Ciudadanía Global; Enseñanza de la Estadística; Aprendizaje de la Estadística; Datos Cívicos.

*Experiências de aprendizagem com dados cívicos para a Cidadania Global*

**RESUMO**

Este estudo rastreia as evidências da Cidadania Global que são reveladas pelas vozes dos participantes quando estão imersos em experiências de aprendizagem relacionadas à ciência de dados. Dados cívicos, software de visualização e princípios de Cidadania Global foram usados para desenhar experiências de aprendizagem que incorporassem algum tipo de problema global (aquecimento global, poluição das águas superficiais, emissões de dióxido de carbono). As experiências de aprendizagem foram implementadas com diferentes populações: alunos do ensino básico, alunos do ensino secundário e professores em exercício e cada encontro foi gravado em áudio e vídeo. As reuniões foram transcritas na íntegra e os sinais de Cidadania Global foram rastreados nas transcrições. Os resultados sugerem que as falas dos participantes oferecem indícios de Cidadania Global nas dimensões cognitiva (conhecimento), socioemocional (empatia, responsabilidade, solidariedade) e comportamental (ações transformadoras) como resultado da exposição a experiências de aprendizagem.

**PALAVRAS-CHAVE:** Ciência de Dados; Cidadania Global; Ensino de Estatística; Aprendizagem Estatística; Dados Cívicos.

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*Data processing and interpretation skills are a pressing need. Those who lack them will fall prey to those who know their secrets.*
Lucía Zapata-Cardona

## Introduction

Global society, understood as an interconnected structure from an economic, political, and cultural point of view (Pak, 2013), a result of the globalization process, has changed the understanding of the world, social relations, and citizenship itself (Stromquist, 2009). This change in understanding requires certain skills in data management from its citizens (Bargagliotti et al., 2020) in academic, professional, and civic fields. However, the instruction received in the mandatory school system on data science does not respond (1) to the complexities of a world in which information abounds (Gould et al., 2017), (2) to the need of informed participation in democratic societies (Engel, 2019), or (3) to the demands of Global Citizenship (Makar, 2023), understood as that sense of belonging, interdependence and interconnection with the global community and humanity (UNESCO, 2015, 2018).

These tensions are evident in the results from research carried out by Facebook, which reveal that a slight manipulation in the algorithm can transform public opinion, feelings, and behaviors of users (O' Neil, 2016). This disgraceful manipulation is not carried out exclusively by the internet giants (a term used to refer to the technology companies that dominate the online environment such as Google, Facebook, Amazon, YouTube). Media owners systematically modify public opinion in their televised news programs when they decide what to report and what to hide. For example, to generate a favorable, or unfavorable, opinion about law enforcement officers, they can report news about a group of police assisting an elderly person or massacring young people in a popular protest. The difference between television news and Facebook (or any other internet giant) is that

this power is invisible and not neutral, although 62% of netizens believe it is (Sandvig et al., 2014).

A few days ago, a video was widely disseminated in which a commercial technician and state economist declared that carbon dioxide emissions have nothing to do with the increase in the planet's temperatures and that the planet's temperatures have not increased since 1998. (Maldita.ES, 2023). Although the video is contrary to scientific evidence, the micro-profiling and micro-targeting techniques used by the internet giants help build an audience to amplify the message of disinformation that, when received by the most vulnerable, is distributed as a true message by the lack of tools to refute these discourses. Global Citizenship, a transformative force that develops awareness about local and global problems that affect daily life (Felices et al., 2016), should equip people with knowledge in data science, values, and dispositions to confront information, battle misinformation and confront so-called "alternative facts."

People are constantly exposed to seeing, reading, and hearing about statistical information, official statistics and civic data, which they require understanding to build informed opinions, to participate in public debates, to shape social policy (Where to invest public resources? How to distribute the budget? Which groups are made invisible?), and to make decisions based on evidence (GAL et al., 2022). This understanding involves the development of knowledge (contextual and technical: visual representations, models, and patterns), skills (interpreting the general meaning of an indicator and asking critical questions: are the reports credible? Are the data up to date? What interests does it serve? Are there alternative ways of analyzing the situation under study?) and dispositions (assume forms of relationship with knowledge? What are the social implications of the evidence? What is the impact of not changing habits? How do the indicators affect my habits?).

However, understanding information from official statistical sources requires knowledge that is usually left out of the school curriculum.

Frequently, programs of studies privilege the technical aspects of statistics (Martínez-Castro; Zapata-Cardona, 2018) that are later unable to be used in settings outside of school (Bakker et al., 2012). The study of civic data in the school system is an effort to overcome this disconnection.

Tensions regarding data management to study, understand and confront global problems (in the sense proposed by Felices et al., 2016) such as waste production, climate change, pollution, greenhouse gas emissions suggest the need to equip people with knowledge, skills, values, attitudes, and dispositions to stimulate public debate, make evidence-based decisions and to respond to local and global challenges (UNESCO, 2015). They are global problems because they are universal and have political, economic, social, and environmental consequences that affect people's lives.

The data skills people need to address global problems do not emerge spontaneously and require intentional interventions. In the specific field of statistics, learning experiences that stimulate critical participation in practices that involve production, visualization, analysis, interpretation and communication of data are required. This implies early training in the school system that prepares people for these challenges, but it also implies equipping those who teach with skills to interpret reality, to face global problems and to contribute to the construction of a democratic world (González-Valencia et al., 2022).

The goal of this study is to trace hints of Global Citizenship in the voices of participants when they are immersed in data science learning experiences designed from civic data. According to UNESCO (2015; 2017; 2018), Global Citizenship addresses three conceptual dimensions of learning: A *cognitive domain* that has to do with knowledge; a *socio-emotional domain* that has to do with the sense of belonging to a community and the shared values of responsibility, empathy, and solidarity; and a *behavioral domain* that has to do with the actions undertaken for a sustainable life.

## Theoretical Framework
### *Global Citizenship*

Global Citizenship implicitly recognizes the processes of globalization and the political, economic, cultural, environmental and development effects on society. The concept of Global Citizenship goes beyond the legal recognition of a person within society and is associated with values that seek to improve coexistence within the community (González-Valencia et al., 2022). The globalization process has connected the world, but at the same time it has made evident and increased global problems such as poverty, inequality, and pollution. The development of social consciousness is essential to face the global problems. The cultural, political, and economic changes that globalization has brought suggest transformations in educational systems that prepare people for the new challenges of a global world. A critical stance of Global Citizenship includes attention to different perspectives, awareness of belonging to a global community, and ethics to act for the common good, change and social justice (Akkari; Maleq, 2020).

According to UNESCO (2015), Global Citizenship comprises three conceptual domains: (1) *Cognitive:* critical understanding of phenomena that arise from the globalization process and the development of analytical tools to interpret them. In this dimension are the knowledge and capabilities required to support the exploration of solutions to global problems. Scientific knowledge is contextualized to contribute to emancipation and social transformation. (2) *Socio-emotional:* A sense of belonging to a common humanity, shared values and responsibilities, empathy, and solidarity. (3) *Behavioral:* act effectively and responsibly at local, national, and global levels for a sustainable and peaceful world.

### Civic Data

Civic data are observational in nature, embody a social interest and are produced by official statistical agencies or by international agencies such as the OECD (Organization for Economic Cooperation and Development), the UN (United Nations Organization) or the World Bank that synthesize them and produce additional multinational statistics. These agencies create and publish reports, datasets, press releases and other data products that are fundamental to understanding societies and their changes (Gal et al., 2022); furthermore, they are the basis of much of the statistical information that the media uses to inform (or misinform) the general public.

The exploration and analysis of civic data generates credible, reliable, unbiased, objective, ethically sound, comparable, open and transparent statistics; helps in understanding the nature of statistics about society (multivariate and dynamic); encourages the understanding and use of indicators (GDP, life expectancy, GINI coefficient) to track social phenomena; favors the development of specific statistical techniques and research methods; offers an objective understanding of society; equips people with knowledge to access statistical reports (Gal; Ograjenšek, 2017). Furthermore, civic data, especially open access data, support democratic processes by stimulating public debate among citizens and informing the design of public policies (Gal et al., 2022).

### Methodology

The study reported in this article follows a qualitative paradigm (Hernández Sastoque; Zapata-Cardona, 2021) and comes from the field work of an ongoing macro research that seeks to develop classroom intervention strategies for data science in the STEM education. The background study has used design-based research (Anderson; Shattuck, 2012) to plan, test and implement lessons based on open civic data that enable data literacy from preschool to high school and that also support teacher preparation.

Several learning experiences were designed using civic data related to global issues (global warming, surface water pollution, carbon dioxide emissions) and implemented with different participants or groups of participants: an elementary school student (third grade), a high school student (grade eleven) and a group of practicing teachers. Once the critical scenarios were selected, databases were generated in rectangular structures in CODAP (Common Online Data Analysis Platform) format from open access civic data. CODAP is an online software that allows interactive visualization and exploration of data.

Participants were given the link that took them directly to the database and were asked the following question: "What questions can be answered with the given database?" While participants (individual or in groups) interacted with the database, they were asked confirmatory questions or questions to stimulate discourse: What do you intend with that action? What does that representation tell you? What other questions can be answered with this data? What conclusions can you draw? What evidence do you have for that conclusion? Interactions with the software and participants' verbal statements were video and audio recorded to facilitate subsequent analysis.

The video recordings were transcribed word by word. Subsequently, and with the support of the transcripts, the videos were watched several times to track indications of Global Citizenship. An analysis process adapted from Powell et al. (2003) was followed and content analysis (Cabrera, 2009) was applied to the participants' statements captured in the transcripts. The purpose of the analysis was not to count the occurrences, but to locate illustrative incidents in which the participants showed indications of Global Citizenship compared with the indicators suggested by UNESCO (2015). From now on, these incidents will be called episodes, and they will be the ones that will guide the presentation of the analysis. The episodes chosen were not necessarily the most representative of the learning experiences but rather those that best

illustrate Global Citizenship. As a reliability strategy, the episodes were chosen at the research seminar of the macro study from which this report is derived. Only the episodes in which there was consensus were candidates to be chosen.

## Results

### Episode 1: The Earth is Warming

This episode came from field work with a third grade participant (9 years old). The purpose of the learning experience was to study climate change from non-traditional data such as those used in some scientific scenarios (see, for example, the work of Sagarin; Micheli, 2001). The participant was given the link to a database about the Nenana Ice Classic contest (database available). This is an annual contest in the city of Nenana, Alaska that rewards whoever comes closest in predicting the exact moment (date and time) in which a tripod located in the frozen Tenana River falls due to the natural thawing of the water when winter ends. The database was structured with multivariate information taken from NASA, which included 105 observations from the year 1917 to 2021 and five variables (year, decimal day of the year, month, day of the month and tripod collapse time).

The participant began the exploration by becoming familiar with each of the variables in the database and with each of the cells. To support the participant in this task, he was asked questions such as could you tell me how to interpret the value 131.28 in observation 5 in the "decimal day of the year" column? (this value represents the 131st day of the year, which in 1921 corresponded to May 11 at 6:42 in the morning). Once familiar with the data, the participant used the "graph" function of the software to construct a bivariate representation in which he integrated the variables "decimal day of the year" and "month" (Figure 1). Given this

action, he was asked: "What do you intend to investigate with that representation?" The participant responded "I want to see which month defrosts easier. […] it seems that May is hotter." Next, the participant constructed a univariate distribution of the variable "decimal day of the year" (Figure 2) and while observing the representation, he expressed "at noon is normally when it is sunniest. When it is sunnier there is a greater chance that the river will melt."

**FIGURE 1:** Representation *"decimal day of the year"* vrs *"month"*
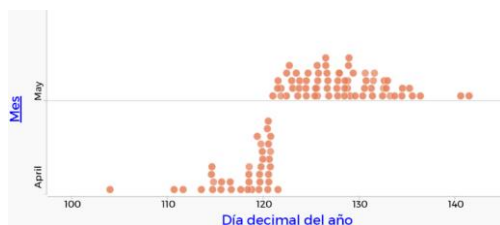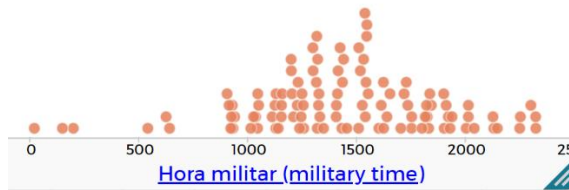


**Note**: Data taken from NASA

**FIGURE 2:** Distribution of variable "decimal day of the year"
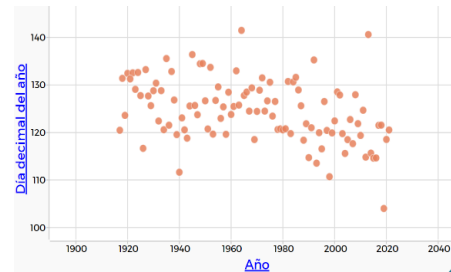


**Note**: Data taken from NASA

Next, the participant constructed a univariate representation of the variable "collapse time" (Figure 3) to which he expressed "there was one [an observation] that melted almost at midnight […] the Earth is warming!" Finally, the participant constructed a bivariate representation in which he integrated "year" and "decimal day of the year" (Figure 4) and there he noticed the trend that as time passed, the tripod collapsed sooner in the year. The participant ended by saying "maybe we have to produce less stuff."

**FIGURE 3:** Distribution of

variable "*collapse time*"



Note: Data taken from NASA.

**FIGURE 4:** Scatter plot "*year*"

and "*decimal day of the year*"



Note: Data taken from NASA.

The participant used the software to support his explorations. Through his speech and his actions, a *cognitive dimension* could be identified in which he used the software to discover univariate and bivariate behaviors. In addition, he used probabilistic language "when it is sunnier, there is a greater chance that the river will melt" and expressed reflections of a descriptive nature "it seems that May is hotter" and an inferential interpretative nature "the Earth is getting warmer." He also identified a *socio-emotional dimension* when he said, "maybe we have to produce less stuff." In this expression the participant suggests a relationship between global warming and consumer habits. Furthermore, the expression reflects a critical thinking (as suggested by González-Valencia, 2022) and denotes the sense of belonging when he speaks in first person "we have to…", including himself as part of the problem, but also as an agent of change. At the end, a timid hint of a *behavioral dimension* is observed when he suggests "maybe we have to produce less stuff."

**Episode 2: This is the only planet we have**

This episode emerged from an interview with an eleventh grade[3] participant (18 years old). The learning experience focused on studying a situation in the immediate environment related to the surface water quality of the river that runs through the city where the participant lived. The participant was given the link to a database on the ICACOSU *surface water quality index* (available database) and was guided in reading and interpreting all the values of the first observation in the table. Once the information in each cell was clarified, the following question was asked: "What questions can be answered with the information that appears in the database?" The database was structured based on official information disclosed in the report *Medellín how are we going* (2020). The database contained multivariate information on 48 observations and five variables: ICACOSU (surface water quality index), year (4 years in which the measurement was made), place (name of the 12 points along the river where measurement was made), latitude and longitude (of the place where the measurement was made).

The participant carried out several explorations. He first opened the "map" option of the software to get an idea of the points where the measurement was taken (Figure 5). Then he made a graph in which he explored the distribution of the water quality index (Figure 6) and expressed "here it shows how the water quality behaves. At some times the index is high and at others it is low […]. The question this information answers is, "What is the quality of the water in the river?"

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[3] In the Colombian educational system, grade eleven corresponds to the last grade of high school. The primary school includes grades one to five, the secondary school includes grades six to nine, and the vocational school (or high school) includes grades tenth and eleven.

**FIGURE 5:** Map of the measurement places for ICACOSU
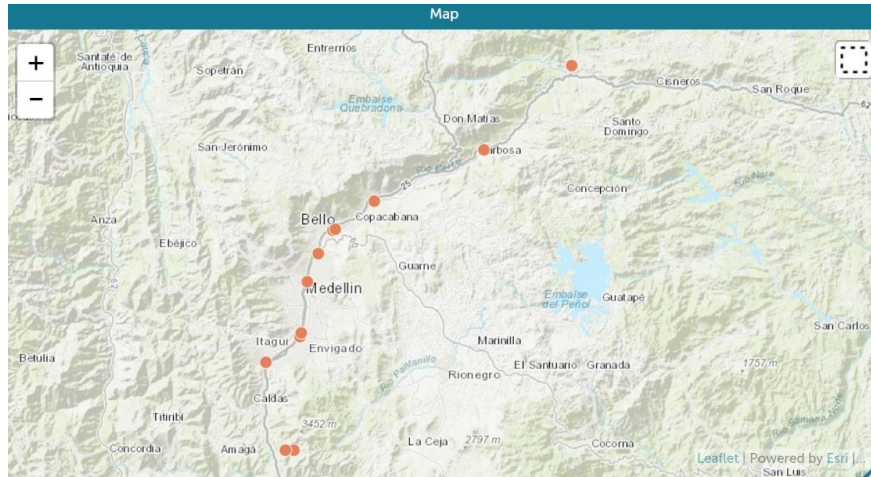


**Note**: Data taken from Medellín how are we going (2020)

**FIGURE 6:** Distribution of surface water quality index (ICACOSU)
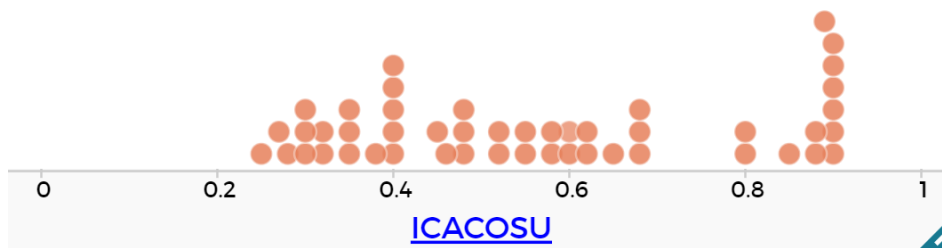


**Note**: Data taken from Medellín how are we going (2020).

Just after this first exploration, the participant constructed a graphical representation of the water quality index incorporating the different measurement points (Figure 7), and immediately expressed "The quality of the water in *Alto de San Miguel* is much higher than in *Niquia* where there are already many more people and companies", "There is a progressive deterioration in the water quality", "The quality improves again after Niquia [one of the measurement points]".

The graphical representation allowed the participant to describe the variation of the water quality index. Although the database did not offer information on the number of people or the number of companies in the points where the measurements were taken, it was contextual information that the participant previously knew and used to establish an association between

urban evolution and the water pollution. Authors such as Gal et al. (2022) call it *contextual civic knowledge*, which seems to favor the interpretation of statistical information.

**FIGURE 7:** *Water quality index* in different *measurement points*
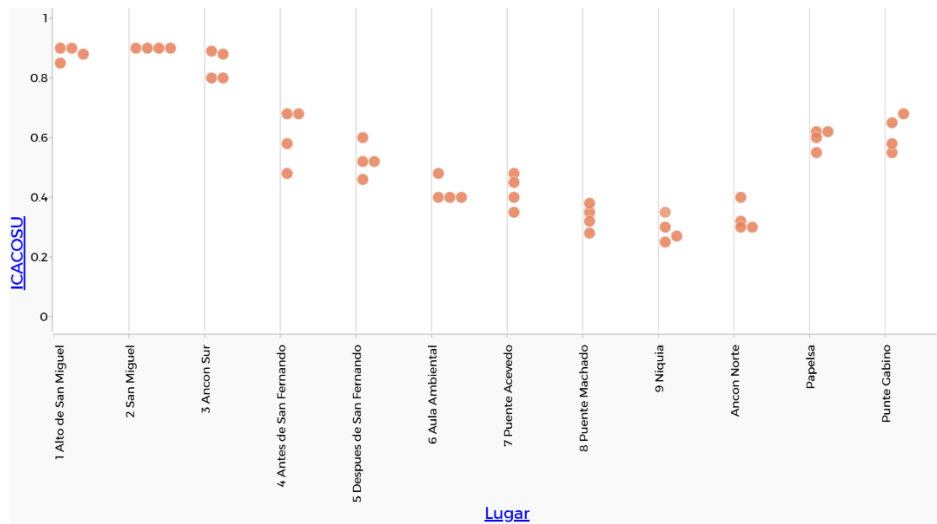


**Note**: Data taken from *Medellín how are we going* (2020)

The participant ended the learning experience by making several statements: "People do not think about the water quality, the quality of the environment," "It would be good if we thought that this is the only planet we have," "We need to reduce consumption, recycle and take care of what we have", "We need to think about energies that do not have fossil fuels."

The explorations undertaken by the participant show that with the database he was able to answer two questions: What is the water quality along the Medellín River? And what is the water quality of the Medellín River in the different points where the measurement is taken? There are other questions that can be answered with the information and that the participant was unable to answer. However, the actions he undertook, and his speech reveal a *cognitive dimension* in which he proposed univariate and bivariate analyzes to describe the phenomenon under study. Expressions such as "The water quality in *Alto de San Miguel* is much higher than in *Niquia*" and "There is a progressive deterioration in

water quality" reflect objective descriptions of what the data says and suggest a hint of informal statistical inference.

The participant's final statements reflect the *socio-emotional dimension*. Although initially he expressed his arguments using third person, "those" who do not think about water quality, as his statements progressed, he expressed his ideas as a protagonist who reflected empathy in a global sense "this is the only planet we have." There is also an indication of *behavioral dimension* when he suggests concrete actions to: reduce consumption, recycle and privilege sustainable energies.

**Episode 3. Transform our consumption habits**

This episode emerged from a professional development program for practicing mathematics teachers teaching at different educational levels. In one of the recurring meetings of the program, a learning experience in data management was proposed to the teachers. They were given access to the link that included a database on carbon dioxide emissions in the world. The database had multivariate information (20 variables) over 59 years (from 1960 to 2018) of the average annual emission per capita (measured in tons) of various countries or groups of countries. The database was structured based on information taken from the World Bank and was presented to teachers in CODAP format (database available). Teachers explored the database on their electronic devices. In their explorations, they used the software's "graph" function to describe the behavior of a single variable in terms of range and center (Figure 8) and to compare the behavior with other variables. They also explored bivariate relationships to study the behavior over time of some variables (Figure 9).

**FIGURE 8:** CO$_2$ emission of Colombia
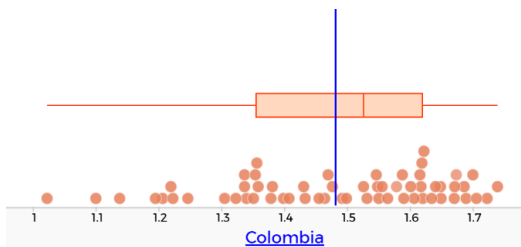


**Note**: Data taken from the World Bank

**FIGURA 9:** Historical CO$_2$ emission of Colombia



**Note**: Data taken from the World Bank

The different explorations of the datasets generated some reflections in the teachers. Teacher Dora[4] suggested that it is necessary to promote "policies that help raise people's awareness. [Real data] makes us aware of what is happening." Teacher Ángela, in a complementary sense, said: "Being given the report is not the same as being able to see the statistics generated from the real data of the problem." The teachers also proposed concrete actions that, from their role as members of a society, they can undertake to reduce carbon dioxide emissions. Some of them were: "Reduce energy consumption" (Eduardo), "Use means of transportation that generate less gases" (Dora), "Use natural light" (Dora) and "Reduce meat consumption" (Henry).

Teachers' actions and discourse as they progressed through the learning experience revealed signs of the *cognitive dimension*. Within the experience they used measures of center and dispersion to describe the behavior of variables, compare variables and propose bivariate analyses. There are also indications of the *socio-emotional dimension* when they referred to the act of raising awareness in others while awakening their own awareness of the phenomenon. Finally, indications of the *behavioral dimension* were observed when they proposed reducing consumption and using clean energy for transportation and lighting.

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[4] All names used in this report are pseudonyms to protect the privacy of the participants in accordance with the regulations for research with humans in Colombia.

## Discussion

The three episodes presented in this report evidence the activation of the cognitive, socio-emotional, and behavioral dimensions of Global Citizenship as participants advance through data science learning experiences designed from civic data. Although the designs of the learning experiences follow an unconventional structure, the results seem promising and suggest being a contribution to both statistical technical knowledge and sustainability (in the sense understood by UNESCO, 2017).

The participants in this study showed indications of Global Citizenship, however, in the *behavioral dimension* only intentions for actions (dispositions) are reported. The empirical information from the study does not guarantee that these intentions are translated into real actions. It is worth providing complementary tools for participants to put their disposition into action. That is, it is necessary to provide them with tools and scenarios to undertake social action.

The learning experience carried out with the primary school student reveals that, from an early age, possibilities can be explored in the management of multivariate data to form the critical sense that global problems require. These results coincide with previous studies that suggest that there is a tendency for adults to underestimate critical capacity in childhood (Makar et al, 2023; Zapata-Cardona, 2023), possibly explained by the limitation of teacher preparation opportunities to address the challenges of teaching statistics in early childhood education (Porciuncula; Batisti, 2023). Perhaps the key may lie in the design of learning experiences.

González-Valencia et al. (2022) propose that the social sciences should be concerned with the preparation of students and teachers in Global Citizenship. The results of this study suggest different conclusions and, on the contrary, reflect that data science, not necessarily within the field of social sciences, can contribute to the empirical study of global problems, promote

the development of consciousness, and work towards the goal of a more informed and sustainable society.

Episode 3 describes the results with a teaching team. There, it was shown that a learning experience based on a global problem allowed the evolution of an initially distant emotional bond ("people") to a much more intimate emotional bond ("they make us aware") through which it was evident that they felt part of the problem and part of the solution, that is, the teachers assumed themselves as agents of change. Furthermore, the reflections raised exceeded the statistical technical knowledge necessary for data analysis and were placed in a critical stance.

These results coincide with those of other studies carried out in teacher preparation settings and under different epistemological roots that showed the development of a social consciousness based on the empirical study of social crises using statistical tools (Zapata-Cardona; Martínez-Castro, 2023 ). Any attempt to link ideas of Global Citizenship in the educational system seems impossible if teachers are not involved (González-Valencia, 2022). Education is essential to understand the logic of globalization and to make evidence-based decisions that support sustainability. If these discussions are not brought to school with teacher leadership, it is very unlikely that they will be learned from other sources.

The school curriculum is far from considering the complexity that data management requires. However, the design of the three learning experiences presented here integrated technical data management, visualization tools, and some global problems. This amalgam allowed the participants to evolve from description, to interpretation and to critical thinking. The results differ from the study by González-Valencia et al. (2022) whose participants, based on an open task, barely reached the description and interpretation. This discrepancy in the results leaves us with concerns about the appropriateness, or not, of the structure of the learning experiences. Should open or not so open experiences be proposed?

It seems that this intersection of the social world, statistics and education that Engel (2019) suggests for Civic Statistics can be the strategy in the design of learning experiences. This intersection is a connecting factor with culture and with data science that could help overcome the limited emphasis of school statistics on procedures and techniques (Bakker, 2012).

The three learning experiences included in this report are based on multivariate data sets. All the participants worked them out, making sense of them, even a 9-year-old participant. According to Engel (2019), civic phenomena are multivariate and dynamic. Many variables that describe civic phenomena are correlated, interact with each other, or have nonlinear relationships. Bargagliotti et al. (2020) suggest that multivariate thinking should be encouraged from childhood because objects have multiple attributes that coexist. A final question remains: what sense does it make to privilege univariate analysis when global problems are multifactorial?

## Conclusions

The reflections generated by the participants as they progressed through the learning experiences reflected empathy, shared responsibility, and honest intentions for change in the face of global problems. Preparation in the empirical management of data on tensions that afflict the world can become a tool to counteract misinformation and to generate critical positions with respect to opinions such as that of the commercial technician and state economist described in the introduction that goes against of all the scientific evidence available.

Data processing and interpretation skills are a pressing need. Those who lack them will fall prey to those who know their secrets. The micro profiling that is so successfully carried out by technology giants to decide what we buy, what we see, where we go and how we think, is a clear example of the power of data science.

Citizens must be aware of the ways in which data is used in society. Internet giants have a potential for abuse that can only be prevented with a citizenry educated in data science and the dimensions of Global Citizenship, which encourages skepticism and an inquiring mind to ask critical questions. Currently, relationships with internet giants are asymmetrical relationships. Preparing citizens for Global Citizenship could help combat these asymmetries.

The results of this study reveal an opportunity in the design of learning experiences that link global issues, civic data, and data science, but also reveal the need for resources to support Global Citizenship preparation for students and for professional development programs.

The learning experiences carried out in this study are based on databases built by a research team. It is worth exploring learning experiences in which participants choose their "burning social issues" and exploring the extent to which this strategy allows the development of Global Citizenship.

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