

THE COVID-19 CRISIS AS A CHALLENGE FOR THE INTEGRATION OF STATISTICAL AND CITIZENSHIP EDUCATION

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The COVID-19 crisis has shown how fundamentally important it is to weigh up risks and probabilities on the basis of statistical data for shaping social coexistence. A vibrant democracy that wants to prove resilient to expertocratic strategies of rule needs citizens who take part in public deliberations and intervene in political affairs. However, without a basic understanding of statistical concepts, it is difficult to follow media coverage of the pandemic and policy actions taken, let alone intervene in political processes. It is therefore necessary to link statistical and citizenship education. We present our concept of a joint course for mathematics and political science students preparing to be secondary teachers that is currently given at Ludwigsburg University of Education (Germany). Empirical results are forthcoming.

THE PANDEMIC AS A CHALLENGE FOR DEMOCRACY

The COVID-19 pandemic has revealed a crisis of democracy. Containment measures not only interfered with the personal liberties of individuals, but social distancing also made it difficult or prevented opportunities for civic self-organization. Political scientists have pointed out the danger of decoupling political decisions from legislative and civil society discourses (Merkel, 2020). On the other hand, the crisis—as so often—also offers opportunities for democratization. It has made us aware that democracies require shared knowledge and participation, thrive on transparency enhanced by good information transfer (Martignon et al., 2021), and therefore demand ‘data inclusion’ and ‘citizen science.’

No doubt, the COVID-19 pandemic, which has been accompanied by an “infodemic” (Ridgway & Ridgway, 2022), i.e., a tremendous onslaught of numbers, graphs, and charts in media coverage, has taught us how fundamentally important it is to weigh up risks and probabilities on the basis of statistical data for shaping social coexistence. Without a decent understanding of statistical concepts such as the ‘reproduction number,’ ‘incidence,’ or ‘overdispersion,’ it is difficult to understand the media coverage of the pandemic situation and the political measures taken. Decisions based on evidence by the political elite as well as compliance on the part of the population both require *statistical literacy* in social and political contexts, i.e., “civic statistical literacy” (Nicholson et al., 2018). A number of survey studies have consistently shown that there is a connection between statistical literacy and the support of non-pharmaceutical interventions to contain the corona pandemic (e.g., Podkul et al., 2020).

As challenging as the task of teaching citizens to ‘read’ statistics is, this would still not be enough to meet the demands of citizenship education in the age of data. Because of the danger described above, that decisions are monopolized by the executive and at most an elitist group of experts can exert influence, citizens are needed who not only get involved in politics as “reflective spectators,” but who are willing to engage in civil society and politics. A vibrant democracy that wants to prove resilient to expertocratic strategies of rule needs a ‘critical mass’ of citizens who take part in public deliberations and intervene in political affairs. In addition to mere “data thinking,” they must be capable of “data doing” and “data participation” (Carmi et al., 2020), a perspective that has been developed in the interdisciplinary field of ‘statistical literacy’ but has so far hardly been adopted by educators in civics and political science.

THE STATISTICS EDUCATION DILEMMA IN SOCIAL SCIENCE TEACHING

The high relevance of civic statistical literacy as an integral part of citizenship education contrasts with its actual value in teaching practice at schools and universities. So far, there have been hardly any studies on *school teaching* in this area. Research by the authors on the curricula of a sample of German federal states revealed that when formulating ‘political competences,’ no reference is made to basic statistical concepts (obviously this would be the case with ‘analytical’ or ‘methodological

skills,' which, in addition to the more comprehensive dimensions of 'political judgment' and 'political capacity to act' are listed as two sub-areas of 'political competence'). In the German-speaking political-didactic discourse, there are (almost) no publications that advocate the systematic integration of statistical literacy into citizenship education (very recent exceptions to the rule are Weber-Stein & Engel, 2021; and for the U.S., Louie et al., 2021), whereas there are, for example, numerous monographs on visual literacy training (e.g., the analysis of cartoons). A comprehensive analysis of statistical visualizations in K–12 textbooks in the field of 'social studies' (Shreiner, 2018) shows that textbooks contain a large number of graphics and diagrams of all kinds, but these are often not systematically integrated into the teaching process. These graphics and diagrams often stand as their own forms of representation next to the texts instead of being integrated into the texts; the tasks relating to statistical information suggest that these represent unambiguous information and insights can be stringently derived (without, for example, clarifying or critically reflecting on the definition of the variables used); and they put the student in an attitude of analyzing and interpreting given data rather than initiating interactive opportunities for data exploration.

Regarding *university teacher training* in the field of political science, things do not look much better. At some (but not all) universities, courses on empirical social research are part of the political science education, but without establishing didactic references to later teaching activities. However, this lack makes it unlikely that positive attitudes towards statistics will develop because these not only depend on the extent of statistical knowledge but also on "good learning experiences" (Estrada et al., 2011), i.e., the domain-specific contextualization of statistics.

Another problem is that interdisciplinary exchange between students of mathematics and social studies subjects is hardly systematically promoted within the framework of university teacher training. Against the background of the separate education at the universities, it is not surprising that mathematics and politics teachers develop little willingness to cooperate at school. As a result, mathematics teachers may stay within their comfort zone and overemphasize a narrow range of statistical techniques and computations, whilst teachers of social sciences can sidestep quantitative approaches almost entirely.

BRIDGING THE GAP: A JOINT COURSE FOR MATHEMATICS AND POLITICAL SCIENCE STUDENTS

'Civic Statistics': Conceptual Framework and Curriculum Recommendation

The approach of the research network ProCivicStat (Nicholson et al., 2018; Ridgway, 2022), which developed the concept of *civic statistics*, is particularly suitable for the implementation of statistical education in the field of political education. Civic statistics is related to the concepts of "critical statistical literacy" (Weiland, 2017) and combines them with modern teaching–learning concepts of statistics (Ben-Zvi & Garfield, 2004). Contexts are no longer just a pretext to learn statistical methods, but socio-political reflections based on quantitative knowledge are the key to building a critical citizenship in which students are no longer observers of the world, but participants and transformers of social crises. Teaching statistics using authentic and complex social contexts is proven to be more sustainable (Ben-Zvi & Garfield, 2004) and contributes to the education of empowered citizens in the information society (Engel, 2019).

For the curricular design of statistical education, the ProCivicStat research group recommends: (a) addressing current and socially relevant social problems; (b) relying on authentic data and texts that reveal the multivariate and dynamic structure of social phenomena; (c) using modern software tools that are available free of charge on the Internet for the versatile and interactive visualization of the data mentioned; and (d) putting a special focus on the critical interpretation and questioning of a large number of data and text sources.

The 'Pandemic Challenge' to Democracy: Political Background Context

The seminar concept outlined below is based on experiences with a joint course for 2nd year mathematics and political science students preparing to be secondary school teachers, which the authors carried out cooperatively in the winter semester 2019/2020 at Ludwigsburg University of Education (Engel et al., 2021, pp. 15ff). This class addressed recent political events—the electoral successes of parties with latent or overt anti-democratic goals and growing political polarization—which have led not only journalistic commentators and feature writers, but also well-known political

scientists to diagnose a veritable crisis of democracy (e.g., Levitsky & Zieblatt, 2018). For the first time since the turn of the millennium, democracies by 2020 were no longer in the majority on a global scale (V-dem, 2020, p. 6).

The COVID pandemic has exacerbated this smoldering crisis of democracy: on the one hand, with a view to China's 'zero COVID' policy, which has been implemented with authoritarian measures and has been successful for a long time, there is a discussion as to whether democratic governments are able to fight the pandemic as effectively as autocratic systems. On the other hand, observers warn that the quality of democracy in many countries has declined in the wake of the COVID-19 crisis because fighting the virus has been given priority over safeguarding civil liberties. Against this background, we have made the tension between the pandemic and democracy the subject of our second joint course, which took place in the summer semester of 2022.

Syllabus Outline: Political Issues, Statistical Concepts, and Data-analyzing Technologies

In order to approach this topic from multiple perspectives, we have constructed three modules, each of which focuses on different political aspects, requires different facets of statistical competence, and can be supported by different technological tools:

- *Module 1* conveys the *epidemiological basics* of the transmission process. Based on a mathematical model of disease transmission, the students use the Common Online Data Analysis Platform (CODAP) to simulate different courses of infection waves, following ideas of Gail Burrill's IASE webinar (see https://iase-web.org/Webinars.php?p=211108_0800).
- In *module 2*, the students compare the *vaccination policies* of countries. They determine connections between the number of vaccine skeptics in a country and other variables, e.g., child mortality (Gapminder), and examine the global distribution of approved vaccines (CODAP).
- *Module 3* looks at the *relationship between pandemic control and democracy*. A distinction is made between the quality of democracy as an independent and as a dependent variable. Do democracies (as independent variable) differ from autocratic governments in their means and efficiency to control the pandemic? A different perspective looks at an impact of governmental measures to combat the virus on democratic liberties ('pandemic backsliding'): Are measures to fight the pandemic associated with a loss of democratic liberties, and which facets of democracy are particularly affected? From a statistical perspective, the concepts of correlation and regression are important to the analyses. In addition, students learn how indices can be aggregated and disaggregated.

EXPLORING THE DATA: EXEMPLARY FINDINGS (MODULE 3 ONLY)

Note: For reasons of space, here we can only report on a few selected aspects of the students' investigations. A more detailed description is left to a forthcoming publication. Although the German students in our course explore the data with a special focus on European countries, we focus in this ICOTS paper on Latin America.

Databases Used

Among the large amount of open data that is available for analyzing the democratic-theoretical aspects of corona politics we picked for the data exploration the index *Pandemic Backsliding: Democracy During COVID-19 (pandem)* (V-dem, 2020). The V-dem Institute, which maintains its own database for measuring the quality of democracy, evaluated quarterly between March 11, 2020, and June 30, 2021, how the state of democracy in a country was evolving throughout the pandemic (<https://www.v-dem.net/pandem.html>).

Latin American States in the COVID Crises: Does Democracy Make a Difference?

In order to evaluate the performance of political systems with regard to their fight against corona, a suitable indicator for the effectiveness of a country's corona policy needs to be identified. A natural measure of effectiveness is the recording of corona-related mortality. Two common and available indicators are the 'case fatality rate' (which depends on the infections detected and thus the testing policy of a country) and 'excess mortality' (which can hardly be manipulated).

Figure 1, *Excess mortality by continent (since 2020)*, shows the distribution of excess mortalities since the outbreak of the pandemic, broken down by continents. (Due to the small number

of states, Oceania is omitted and the North American states are included in “Americas.” Africa is excluded because excess mortality data are only available for a small subset of countries; see <https://ourworldindata.org/excess-mortality-covid>). Consistent with the literature (Malamud & Núñez, 2021), the visualization suggests that America has been particularly hard hit by the pandemic. The median excess mortality is higher at 19.5 percent than in Asia (16%) and Europe (12.8%). Excluding the North American countries, Canada and the U.S., Latin America achieves a median excess mortality rate of 23.5 percent.

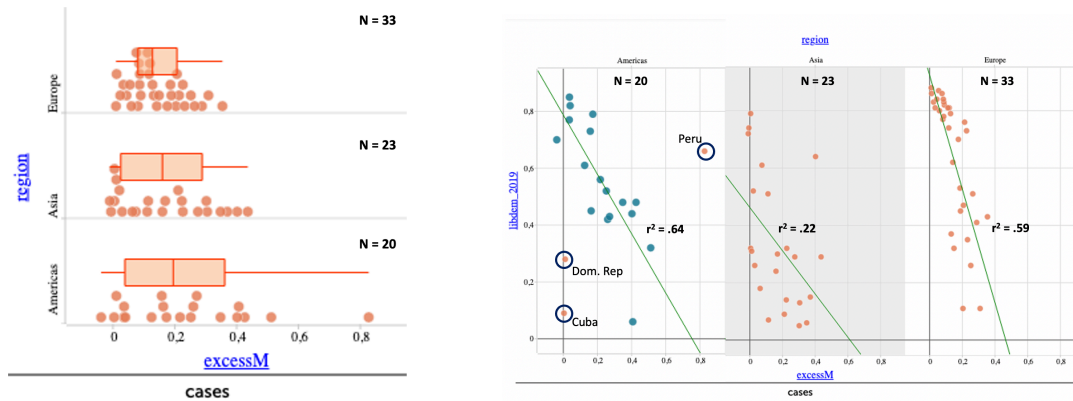


Figure 1. Excess mortality by continent Figure 2. Quality of democracy vs. excess mortality

To answer the question of how efficient democracies (as opposed to autocratic regimes) were in containing the pandemic, the quality of democracy must be added as an independent variable. We use the well-established *Liberal Democracy Index* by V-dem, which combines information on suffrage, the freedom and fairness of elections, freedoms of association and expression, individual and minority rights, equality before the law, and executive constraints. It ranges from 0 (autocracy) to 1 (fully developed democracy). Figure 2, *Quality of democracy vs. excess mortality*, displays scatterplots of the democracy index at the end of 2019 (*libdem_2019*) versus excess mortality (*excessM*) since January 1st, 2020, separated for each continent.

The visualization of the relationship between the quality of democracy (before the pandemic) and excess mortality shows a striking finding: there is a negative correlation between the quality of democracy and the amount of excess mortality on all continents. In Asia, the percent of variance in excess mortality explained by the quality of democracy is weak, whereas it is moderate to substantial in Europe and the Americas (after removing the outliers for Peru, Dominican Republic, and Cuba).

However, it is important to caution students against overinterpreting their findings and attributing democracy to being more effective in dealing with the pandemic. At this point, the notion of ‘confounders’ needs to be considered. It is worthwhile to discuss with students which lurking variables might be intervening (e.g., age structure of society, rate of government health spending, per capita income, Gini coefficient, etc.).

Are Established Democracies More Resilient Against ‘Pandemic Backsliding’?

According to the assessment of regional experts, the pandemic has exacerbated a previously existing crisis of democracy in Latin America. After the region had experienced a wave of democratization since the late 1970s, in the course of which a liberal-democratic form of government was reestablished or established for the first time in almost all countries, progress in democratization has been stagnating or declining in the past ten years. In many countries democracy is fragile and challenged by social inequalities, a rising polarization, and a fragile rule of law. The various democracy indices differ sometimes considerably in their scoring, depending on the underlying understanding of democracy, but there is agreement that (albeit in different order) Chile, Uruguay, and Costa Rica are the most democratic and Venezuela, Nicaragua, and Cuba are the least democratic countries on the continent. Regional surveys suggest that support for democracy has diminished for over a decade (Malamud & Núñez, 2021).

In order to fight COVID-19, in several countries, ‘states of emergency’ have been proclaimed by presidential decrees that have restricted the opposition’s options for action and the constitutional rights of citizens. However, the enactment of extraordinary measures is not per se a threat to democracy; if such measures meet the requirements of proportionality, if they are limited in time, and if the constitutional separation of powers is also preserved, they do not violate the rule of law. The Pandemic Backsliding Index (*pandem*), ranging between 0 (no violations) and 1 (serious violations of constitutional principles), determines how strict the containment measures taken violate these constitutional requirements.

Plotting the quality of democracy before the pandemic (*libdem_2019*) with the *pandem* score (Figure 3) shows a weak trend for Latin America ($r^2 = .12$). As expected, the states with the greatest violations of constitutional principles include Venezuela and Cuba, as well as El Salvador and Mexico. Democratic ‘champions,’ Chile, Uruguay, and Costa Rica, have minor to moderate rule of law violations, albeit more so than Bolivia and the Dominican Republic; despite a solid democracy score, Argentina has a relatively high *pandem* score.

Indices (such as the *Liberal Democracy Index* or the *Pandemic Backsliding Index*) have gained enormous importance in political science in recent decades. They offer advantages when it comes to compression and thus a reduction in the complexity of individual information. At this point, however, the students should also be made aware of possible dangers of indices that can be found on the level of conceptualization and aggregation. In order to convey to the students that indices can be independently disaggregated and re-aggregated based on the raw data, they are given the task of breaking down the *Pandem Index* and creating new sub-indices.

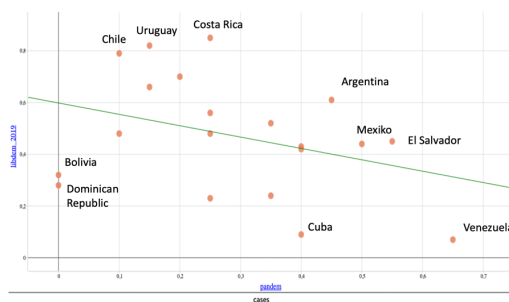


Figure 3. Quality of democracy vs. PanDem

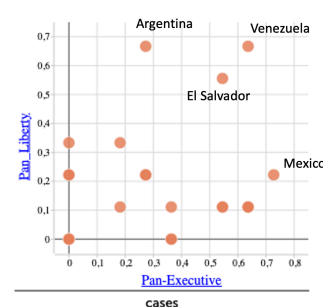


Figure 4. Two dimensions of pandemic backsliding

From the point of view of democratic theory, it is interesting to differentiate more precisely what kind of violations of constitutional regulations are involved. In principle, a distinction can be made here between restrictions on individual freedoms (e.g. freedom of assembly) and a weakening or abolition of the separation of powers (e.g. postponing elections, restricting the powers of the legislature). The items underlying the *pandem* index make it possible to record violations in these two dimensions separately. Our students are given the task of creating two sub-indices that indicate (a) violations of freedoms: *Pan_Liberty*, ranging from 0 (no violations) to 1 (severe infringements), or (b) accumulations of power in the executive: *Pan_Executive*, equally ranging from 0 (no abrogations) to 1 (major violations of the separation of powers). In Figure 4: *Two dimensions of pandemic backsliding* we have plotted these two variables. While states with already strong authoritarian tendencies (e.g., El Salvador and Venezuela) show violations along both dimensions, in Argentina, civil liberties have been restricted, but the separation of powers has not been affected by the same extent. The populist Mexican president, López Obrador, on the other hand, seems to be using the pandemic to consolidate his power.

EMPIRICAL RESEARCH

We are going to evaluate the seminar ($N = 34$) with regard to its effectiveness in teaching civic statistical literacy. The constructs to be surveyed are: ‘attitudes towards statistics’ and ‘statistical knowledge’ as well as ‘internal political efficacy’ and ‘self-attributed political competence.’

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