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THE IMPORTANCE OF STATISTICAL LITERACY FOR DEMOCRACY – CIVIC–EDUCATION THROUGH STATISTICS

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Civic Education has had the same objective ("Mündigkeit") for the last 50 years, but the conditions to achieve it have changed. Mündigkeit is a prerequisite for citizen's participation, to strengthen and stabilize democratic structures. In the information age, Mündigkeit regarding statistics means having an orientation in the confusion of the modern information jungle and the deluge of quantitative information and statistics. The requirements for understanding and evaluating information about societal developments have changed: Statistical skills are becoming increasingly important for an evidence-based judgment in today's society. They entail understanding data-related arguments and representations, questioning possible conclusions as well as uncovering opinions and already made decisions.

NEEDS OF DEMOCRACY

Democracy is not only a form of government but also a political system. It has an impact on the society, the culture, and everyday life. Himmelmann (2001), a German political scientist, distinguishes between the individual level, the societal level and the institutional level. Democracy impacts all three of these levels and affects them sustainably. Negt (2011) argues that a consistent democratization of all the three levels is the only way to keep the democratic system as a whole alive. To be able to function, democracy needs *Mündigkeit* and the people in the respective levels need to be *mündig*. If a person is, for example, a patient (individual level), *Mündigkeit* could mean he should not make his way of life dependent on the doctor (Böhme, 2010). *Mündigkeit* in the case of a consumer (societal level) could mean he should know what goods and services he needs for his life (Buchholz, 2010). *Mündigkeit* for a citizen (institutional level) could mean to know how to participate within the system (see Negt, 2011).

The German word *Mündigkeit* has various meanings. It is attributed to Immanuel Kant (see Böhme, 2010), "to use one's own mind without the guidance of another person." It refers to a cluster of ideas around the goals of the enlightenment movement: empowerment to represent one's own interests; emancipation in the sense of detachment from the authorities; self-determination to decide freely about one's own life; taking responsibility about one's own life; maturity of being able to reflect the effect of one's own acting; autonomy in the sense of recognition of opinion-making and already made decisions as well as making independent informed decisions. All these concepts are possible characteristics of *Mündigkeit*.

Mündigkeit is a prerequisite for participation in the democratic system (Dammer & Wortmann, 2014). The people should know about what they want to achieve and how to realize it. For further development of the democratic system, it is necessary to reflect what could be done better and where change is needed. Participation in democratic processes contributes to the stabilization of the democratic system (Dammer & Wortmann, 2014). *Mündigkeit* is also important for the development and maintenance of the democratic culture (Frech & Richter, 2013). In relation to societal life, a reflection of the personal needs and interests is important for shaping society and everyday life. Dammer & Wortmann (2014) emphasize that democracy can also function or exist without *Mündigkeit*, but only if citizens understand themselves as an audience and are satisfied with the production of its appearance.

REQUIREMENTS FROM THE PEOPLE

Demanding the concept of *Mündigkeit* as a characteristic among citizens is not new. Immanuel Kant already called *Mündigkeit* an important characteristic for people in 1794 (see Böhme, 2010; Villhauer, 2010). Theodor Adorno formulated the evolvement towards *Mündigkeit* as a basis of democracy at the end of the 1950s (see Adorno, 2015). Also in modern times political scientists in Germany have described *Mündigkeit* as a bundle of qualities to shape their live (see Dammer & Wortmann, 2014), as a prerequisite for participatory acting (see Breit & Massing,

2013) or the ability to distinguish (see Bünger, 2013). In recent years, the critical handling of data has become an important part of *Mündigkeit*. Gramm (2010), for example, specifies *Mündigkeit* as "having an orientation in the confusion of the modern information jungle". According to Fischer (2012), *Mündigkeit* "enables the people to obtain the necessary information from the media and make sense of data." (p.11).

Requirements on the different levels of democracy

The change described above is also reflected in the requirements on the respective levels of democracy. In each of the levels, the people have to deal with the data deluge, with the associated difficulties and possibilities. People in their private and public life are constantly challenged to make decisions that go beyond their knowledge and competences (see Lengnink, Meyerhöfer & Vohns, 2013). For this reason "it is important to learn to get the necessary information, to ask questions, to understand" (Lengnink, Meyerhöfer & Vohns, 2013, p.4) to be able to make decisions based on *Mündigkeit*.

As the three levels have some features in common, it is also important to understand, verify, interpret, and critically evaluate data-related arguments and various representations (see Engel, 2014; Ridgway, 2015) at each of the three levels.

Requirements at the individual level are, for example, as a patient (see Böhme, 2010):

- Handle risk as an essential ingredient of life.
- Understand and evaluate medical test-results.
- Make decisions in the therapeutic process.

Requirements at the societal level are, for example, as a consumer (see Buchholz, 2010):

- Understand and evaluate advertising based on various study results.
- Evaluate recommendations from different institutions.
- Make adequate evaluation of one's own needs

Requirements at the institutional level are for a citizen:

- Understand concepts that describe social developments (see Engel, 2014).
- Take a critical attitude towards data-based /statistical statements (see Schiller, 2016).
- Evaluate and classify opinion surveys, political forecasts and status reports

Needed knowledge about information

Another important issue is to differentiate between information and opinion (see Schiller & Engel, 2016), not only since 'post-factual' has been the word of the year 2016. Data-based statements are increasingly used. Figure 1 shows the stages how data-based information is produced,

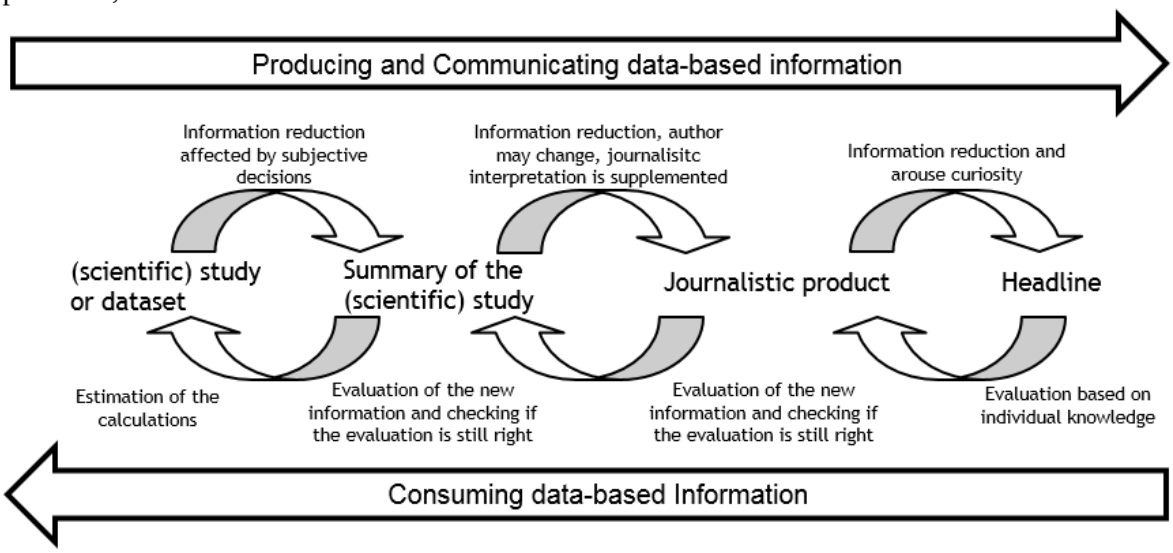

Figure 1

communicated and consumed. The terms refer to Gal (2002) and Rumsey (2002), which distinguish between data-producers, data-communicators and data-consumers.

The upper part shows the producing and communicating of data based information, from the (scientific) study over a summary of the (scientific) study to a journalistic product with the headline as an eye-catcher. There can be more steps if the first journalistic product is the basis for further ones. In this context, people should be aware of the fact that at every step of produced and communicated information there is an information reduction that is influenced by subjective decisions. A change of the author strengthens the subjective character of the transmitted information since further decisions were made. This makes it difficult to keep opinions and information apart at first sight which should, however, be considered while consuming data based information. The interpretation and evaluation of the headline is the first step (see Figure 1 lower part from right to the left). The headline is judged based on the own knowledge. After the decision that it is worth searching for further information, the additional information of the journalistic product is evaluated and judged again by means of one's own knowledge. In times of data-driven journalism, links to further information and references are found in more and more journalistic products. Sometimes the reader can even access the original datasets and check calculations or perform own analyses. In order to be able to carry out each of these individual steps, a wider knowledge of statistics is required (more than is normally taught at schools), in addition to critical evaluation and reflection as well as positive dispositions (see Ridgway, Nicholson & Gal, 2017).

Needed knowledge of statistics

To understand data-based arguments or to uncover opinions and already made decisions with regard to societal phenomena in the media, citizens who are *mündig* need knowledge of statistics that goes beyond traditional statistics courses.

- Statistics and risk
  In addition to the classical themes of statistics and risk like variability, describing and comparing distributions, correlation or regression and the concepts of probability and conditional probability (including Bayes theorem), the citizen also needs to know about statistical topics such as samples, representativeness, signal and noise, Bayesian inference or effect size. Understanding ideas around Big Data such as variety of data sources or techniques of analysis (see Ridgway, Nicholson & Gal, 2017) is also necessary.
- Modelling and representation
  Complex societal phenomena are not easy to measure. In addition, there is more than just one way to model a particular phenomenon: The decision for the model mostly depends on the background of the researchers. Representations can help in understanding social phenomena. *Mündigkeit* requires a familiarity with static and dynamic visualizations (see Ridgway, Nicholson & Gal, 2017). The way a latent variable is defined influences the measurement and, consequently, the result. The "scientific" definition is not always consistent with the everyday definition, which can lead to misunderstandings.
- Methodology of data collection
  Different issues require different approaches. A critical analysis of the strengths and weaknesses of a research method should be conducted (see Ridgway, Nicholson & Gal, 2017). In some cases, however, ethical reasons also determine whether an experiment, an observation study or a survey is appropriate as a research method.
- Contextual knowledge
  Contextual knowledge is of essential importance for the interpretation of social phenomena. The more background knowledge is available in the corresponding reference framework, the better can the information about the phenomena be evaluated regarding its plausibility. Likewise, prior knowledge helps to continue the examination with more detailed information.

Under *Civic Statistics*, various facets are subsumed and divided into three groups (engagement and action, knowledge and enabling processes), which are of importance in the daily handling with statistics within the three democratic levels (see Engel, Gal & Ridgway, 2016;

Ridgway, Nicholson & Gal, 2017). Ridgway, Nicholson & Gal (2017) described all of the above-mentioned elements as part of the group *knowledge* of Civic Statistics.

CONCLUSION

Democracy is inconceivable without *Mündigkeit*. Consequently, *Mündigkeit* has always been an important educational goal within democracy. In recent years, however, due to the change into an information society, the requirements for *Mündigkeit* have changed. Knowledge and skills from the field of Civic Statistics are becoming increasingly important for *Mündigkeit*. Above all, as far as the information procurement within the media is concerned, a large number of the arguments in the social field are data-based. That makes *Mündigkeit* inconceivable without Civic Statistics. If we follow the analogy, democracy is inconceivable without Civic Statistics.

There is obviously a need for training Civic Statistics as a component of civic education. However, Civic Statistics are hardly provided, neither in the school curriculum nor in teacher training. Due to its importance to democracy, we claim that Civic Statistics should have its own place in the school curriculum and not just be handled as part of teaching mathematics, social sciences, politics or geography.

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