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Mapping Mental Models of Science Communication:

Analyzing How Scientists in Germany, Austria, and Switzerland Understand and Do Science Communication

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1 Models of Science Communication

Deficit model (1960s), Public Understanding of Science (PUS; 1980s)

- Idea of a deficit of knowledge or understanding among scientific laypersons that needs to be eliminated
- Science communication process as hierarchical, top-down, one-way dissemination of communication

(Bauer et al., 2007; Bucchi & Trench, 2014; Schäfer et al., 2019)

Public Engagement with Science (PES; 2000s)

- Aim: Initiate a two-way dialogue between science and the public
- Importance of interaction and dialogue among different stakeholders

(Akin, 2017; Schmid-Petri & Bürger, 2019)

Strategic Science Communication

- Aim: Legitimation of science and its protagonists
- Pushed on by competition & increased importance in science and research institutions

(Besley et al., 2019; Nisbet & Markowitz, 2016)

Mental models: declarative and procedural knowledge, to understand, describe, and assess specific phenomena (Al-Diban, 2012)

- are involved in regulating action processes (Al-Diban, 2012; Johnson-Laird, 1983)

2 Explanatory Factors for Applied Science Communication

Factors, which lead academics to interact with the public:

- **Studies for countries** e.g., Argentina (Kreimer et al., 2011), France (Jensen, 2011), Germancy (Marcinkowski et al, 2014; Peters, 2009), Norway (Kyvik, 2005), Switzerland (Crettaz von Roten, 2011), the UK (Poliakoff & Webb, 2007), USA (Dudo & Besley, 2016; Dunwoody et al., 2009), across countries (Entradas & Bauer, 2019; Peters et al., 2008)
- **Studies for disciplines** as natural sciences (Besley, 2015; Dudo & Besley, 2016), astronomy (Entradas & Bauer, 2019), bioscience (Dunwoody et al., 2009; Peters et al., 2008; Rödder, 2009), climate science (Ivanova et al., 2013; Post, 2016), or across disciplines (e.g., Crettaz von Roten, 2011; Poliakoff & Webb, 2007)
- **Factors on the level of individual researchers** e.g., age & gender (Burchell, 2015), nationality (Pew Research Center, 2015), status (Entradas & Bauer, 2019), disciplinary affiliation (Besley et al., 2018; Yeo & Brossard, 2017), attitude on public communication (Besley et al., 2018), communicative self-efficacy, sense of responsibility (Allgaier et al., 2013; Besley et al., 2018; Dudo, 2013), perceived social norms (Besley, 2015)
- **External factors** e.g., career incentives (Jacobson et al., 2004), funding & lack of time (Allgaier et al., 2013)

3 Research Questions

RQ1: **Among which groups of academics in Germany, Austria, and Switzerland do the models predominate?**

RQ2: **What science communication behaviours are these mental models associated with?**

4 Method

Method: representative web survey among academics at higher education institutions in Germany, Austria, and Switzerland (DACH region)

Field time: February 14, 2020 to April 30, 2020

Survey data: *N* = 15,972 academics from 236 institutions (response rate: 11,33%)

Germany: *n* = 8,228 (51.5%); Austria: *n* = 2,832 (17.7%); Switzerland: *n* = 4,912 (30.8%)

- Documentation of data set, survey elements (item batteries, questions), special features of sampling, ethics approval & data cleansing →

Variables & constructs

- **Sociodemographic factors**
- **Academic work and research situation**
- **Practical science communication** (9 items)
- **Subjective perceptions of science communication** (13 items with reference to the three models PUS, PES-items & Strategic Science Communication)
  - exploratory factor analysis → three-factor solution explains 52.68% of the variance & map the theoretical expectations about the three mental models)

5 Results

RQ1: Explanatory factors for & inclination to each mental model (multivariate regression analyses)

Public Understanding of Science (Adj. R^2 = 0.06)

Sociodemographic factors:
female & older academics, academics from Austria & Switzerland

Academic status & employment conditions:
pre-doctoral & part-time researchers

Perceived work situation:
high sense of meaning for one's own work, low discrepancy between desired time for research and time available

Science field:
life sciences, natural sciences

Public Engagement with Science (Adj. R^2 = 0.08)

Sociodemographic factors:
female & older academics, academics from Austria & Switzerland

Academic status & employment conditions:
pre-doctoral & part-time researchers

Perceived work situation:
high sense of meaning for one's own work, low discrepancy between desired time for research and time available

Science field:
humanities, social sciences, life sciences

Strategic Science Communication (Adj. R^2 = 0.11)

Sociodemographic factors:
female academics, academics from Austria & Switzerland

Academic status & employment conditions:
predoctoral researchers, researchers who teach less & have no tenured contract & are employed only part-time

Perceived work situation:
perceived intense competition, high pressure to obtain external funding, high work load, high sense of meaning for one's own work

Science field:
humanities, social sciences, life sciences, engineering scholars

RQ2: Correlation with practice of science communication (medium to strong bivariate correlations)

---------- "Conversations with members of the public give me inspiration for my research." (|*r*| = .38 to .55, *p* < .001) ----------

---------- "I actively seek ways to effectively communicate my research findings to the public." (|*r*| = .38 to .55, *p* < .001) ----------

- "I have had controversial discussions with members of the public about my research" (*r* = .32, *p* < .001)
- "I use social media such as YouTube, Twitter or Facebook to inform the public about my research." (*r* = .32, *p* < .001)
- time spend on communicating science (*r* = .22, *p* < .001)
- wish to spend more time per week on science communication (*r* = .30, *p* < .001)

6 Discussion

Mental models of science communication among academics in the DACH region

- Sociodemographic factors & perceived labor situation had the strongest explanatory power

PES is most widespread & accompanied by correspondent practice (Besley et al., 2018; Bucchi & Trench, 2014) **vs. dominance of deficit model approaches** (Ridgway et al., 2020, Simis et al., 2016; Su et al., 2017)

- Possibly a consequence of the programmatic orientation of science policy, e.g., through funding agencies (Schäfer, 2009; Yeo & Brossard, 2017) and/or new social norms (Burchell, 2015)
- Science communication as a process between equal and active actors (Bucchi & Trench, 2014; Schäfer, 2009; Schmid-Petri & Bürger, 2019)

Precarious working conditions → model of Strategic Science Communication

- shift in the mental models due to the changing conditions in the academic system, which particularly affect junior academics (e.g., Fang & Casadevall, 2015; Metz-Göckel et al., 2016)
- Science communication as a strategic tool in competition

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