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

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

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

2 Explanatory Factors for Applied Science Communication

Factors, which lead academics to interact with the public:
- Studies for countries e.g., Argentina (Kessler et al., 2011), France (Veres, 2011), Germany (Burdick et al., 2014; Peters, 2006), Norway (Knyff, 2006), Switzerland (Cretés & Renz, 2011), the UK (Pollet & Webb, 2003), USA (Duck & Benser, 2016; Durán & Cuello, 2006), 21 COUNTRIES (Grégoire & Bazer, 2018; Peters et al., 2008)

- Studies for disciplines as natural sciences (Duck, 2015; Duck & Benser, 2016), astronomy (Grégoire & Bazer, 2016), bioscience (Durán & Cuello, 2006; Peters et al., 2008), R&D (2016), Climate science (Barea et al., 2015; Plot, 2016), or across disciplines (e.g., Creutz & Woll, 2011; Poles & Bel, 2007)

- Factors on the level of individual researchers e.g., age & gender (Suit, 2011), nationality (Poles & Bazer, 2016), status (Grégoire & Bazer, 2016), disciplinary affiliation (Duck et al., 2016; You & Besser, 2017), attitude on public communication (Bener et al., 2016), communicative self-efficacy, sense of responsibility (Vogler et al., 2012; Bener et al., 2016; Duck, 2015), perceived social norms (Duck, 2015)

- External factors e.g., career incentives (Jacobson et al., 2004), funding a lack of time (Bener 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 = 8,229 (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 \( R^2 = 0.06 \) 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. \( R^2 = 0.03 \))
- 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: precarious working conditions → model of Strategic Science Communication
- 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."
- "I actively seek ways to effectively communicate my research findings to the public."
- "I use social media such as YouTube, Twitter or Facebook to inform the public about my research."
- "I wish to spend more time per week on science communication."

- "I have had controversial discussions with members of the public about my research."

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; Burch & Trnovc, 2014) vs. dominance of deficit model approaches (Kavanagh et al., 2020; Simis et al., 2014; Su et al., 2017)

- Possibly a consequence of the programmatic orientation of science policy, e.g., through funding agencies (Scholler, 2009; You & Besser, 2017) &/or new social norms (Bachul, 2016)

Science communication as a process between equal and active actors (Bachul & Trnovc, 2014; Scholler, 2009; You & Besser, 2017)

Precarious working conditions → model of Strategic Science Communication
- Shift in the mental models due to the changing conditions in the academic system, which particularly affects junior academics (e.g., Fang & Cassandra, 2010; Metz-Göckel et al., 2016)

Science communication as a strategic tool in competition