

# **A decision theatre as a digital environment for teaching mathematics**

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## **Decision theatre as a science communication tool**

Mathematics is an integral, however often unperceived, part of social and policy-relevant decision-making processes. As a science communication tool, Decision Theatres (DT) provide an environment for participants to become able to use mathematics critically as a tool to tackle societal challenges. A DT is an interactive and discursive framework facilitating group decision-making on various socially relevant issues and challenges. A DT is typically situated in a highly IT-supported visualisation environment, allowing groups to base their discussions on mathematical models and simulation tools (Miller et al., 2019). To create future scenarios of sustainable mobility in Germany and make them accessible to the broad society, the Global Climate Forum adapted the DT in 2018 and based it on an underlying agent-based Mobility Transition Model (Wolf et al., 2023). The system is represented at the micro level of the actors, their interactions with each other, and with the common environment. This poster presents how such a novel format can also be used as an IT-supported teaching environment. In the following, we will highlight why a DT is an adequate learning environment for strengthening modelling skills in mathematics teaching.

## **Decision theatres as a teaching environment**

DTs can not only be used in science communication for the broad society but also provide an interactive and problem-oriented teaching environment for students that implements the insights of constructivism in learning theory (see also Sjøberg, 2010). Here, the DT's model and simulation results serve as a basis for discussion and momentum for exploring the possible consequences of certain decisions. DT supports the decision-making process through mathematical modelling and thus enables an interactive-discursive decision-making process. The goal is for the students to learn how a mathematical model is built and to enable students to communicate about the mathematical model and evaluate its output. Modelling, as it takes place in DT, emphasises contexts and problems that challenge and encourage students' independent and responsible decision-making. These decisions are made through participatory dialogue, without the teacher or any other person having the decisive authority or that the problem predetermines the outcome. Within the learning environment, a task type comes into play that goes beyond a pure text task and meets the criteria of authenticity, realism and openness. The focus is on the core aspect of mathematical modelling: a problem relevant to society from the non-mathematical world is translated into mathematics and prepared to be discussed productively in the non-mathematical world.



Figure 1: Decision Theatre on sustainable mobility

## An adapted decision theatre for mathematical model comprehension

Process and content of the Decision Theatre on sustainable mobility. The DT event is divided into three phases:

**Introduction:** In this first phase, the initial problem is outlined: The mobility developments in Germany and the associated CO<sub>2</sub> emissions are visualised on the available screens. Subsequently, agent-based models, in general, and the basic properties of Mobility Transition Model are explained. Finally, the options available for selecting a concrete scenario are presented.

**Decision situation:** In small groups, the participants now agree on a subset of the available policy measures (e.g. weight restriction of combustion cars), investment decisions (e.g. subsidies for electric cars) and external developments (e.g. petrol price increase). The goal is to reduce CO<sub>2</sub> emissions. However, the choice is so limited that not all options can be selected. This restriction encourages discussion in the groups.

**Exploration:** In the last part of the session, the group presents its choice, and the consequences of the choice simulated by the model are visualised on the screens and compared among the groups. The participants are asked to make assumptions about the emergence of effects and interactions to shed light on potential causalities, (undesired) side effects and consequences. Finally, the plausibility of the results is reflected. The participants' reflections are starting points for the mathematicians to revise the model.

## References

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