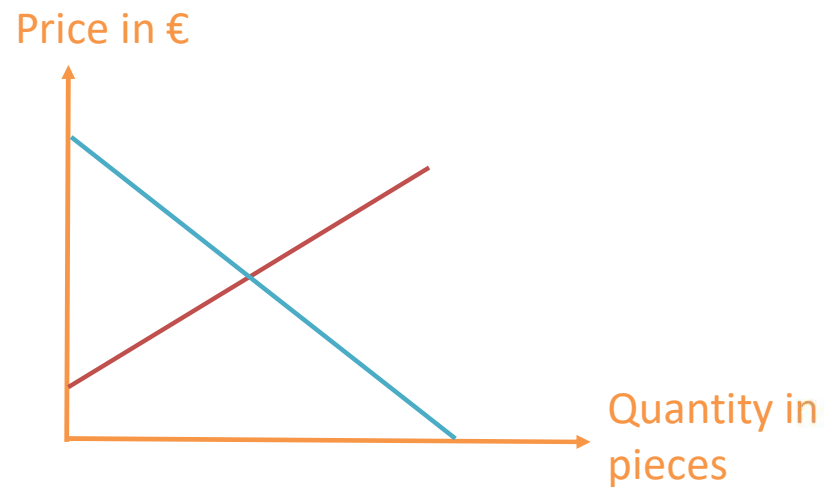




Axis diagrams as an aid or hurdle in economic education

A qualitative interview study of student understanding



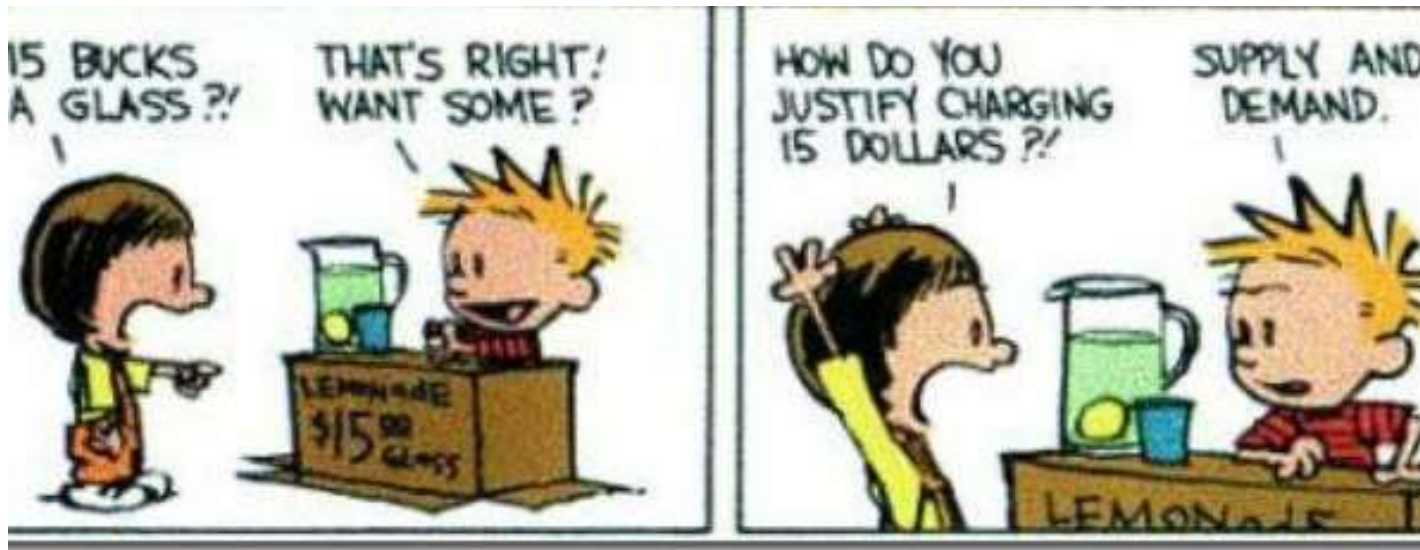
Jana Franke & Franziska Birke

23RD EUROPEAN ECONOMICS EDUCATION CONFERENCE

UNIVERSITY OF EDUCATION FREIBURG
JANA FRANKE UND FRANZISKA BIRKE



Research question for the PhD



(Source: <https://www.pinterest.de/pin/147704062748415108/>)

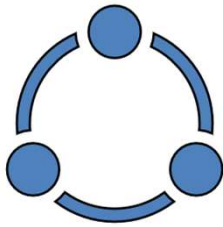
What are qualitatively different explanations of price formation in markets by students based on the price-quantity diagram?



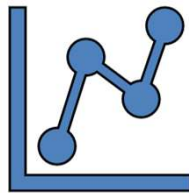
"How we know what we know [about "economics"]"

(Translated from Knorr-Cetina, 2002, S.11)

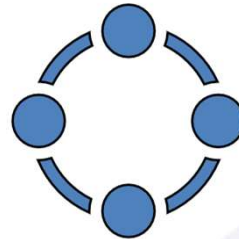
Mathematical modeling of
economic models



Axis diagram



Economic model /
theory



Model



Reality



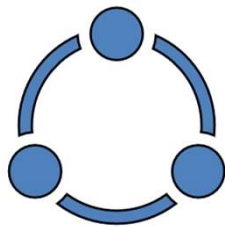
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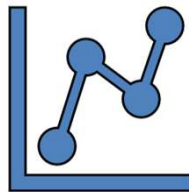
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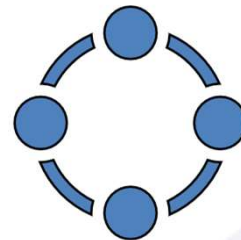
Mathematical modeling of economic models



Axis diagram



Economic model / theory



Model



Reality



???

"Man cannot face the world directly, he cannot escape his own inventions." (Translated from Cassirer, 1990)

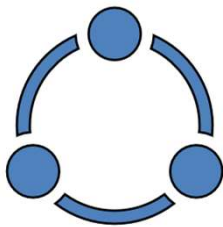
--> Representations empower people to find their way in reality (Ankersmit, 1997; Barbarowski, 2008)



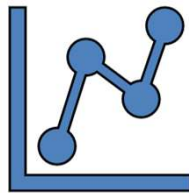
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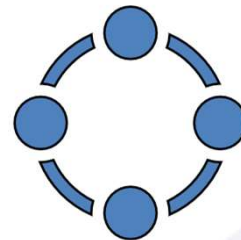
Mathematical modeling of
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Axis diagram



Economic model /
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Model



Reality



???

"The word model belongs to that class of terms which are characterized by relatively frequent use as well as - at least in the context of economics - by a relatively low clarity of their respective definitions"

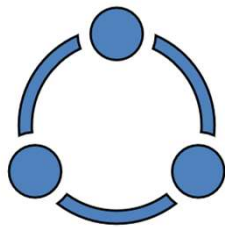
(Translated from Dinkelbach, 1973, p.1)



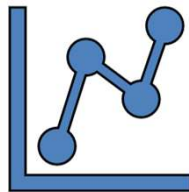
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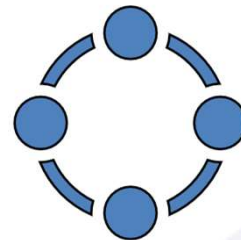
Mathematical modeling of economic models



Axis diagram



Economic model / theory



Model



Reality



???

Ontological perspective on models

(Stachowiak, 1973; Gilbert und Justi, 2002)

→ Epistemological perspective on modes

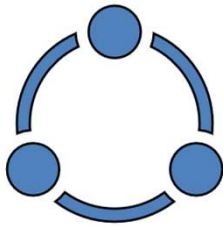
(Mäki, 2005, Mahr, 2008, 2015; Gilbert und Justi, 2016)



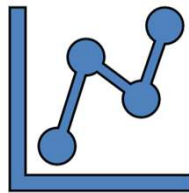
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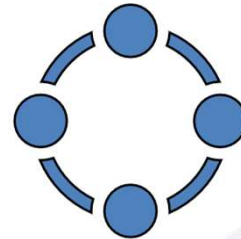
Mathematical modeling of
economic models



Axis diagram



Economic model /
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Model



Reality



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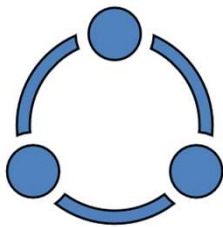
e.g. production and application perspective
by Mahr (2015)



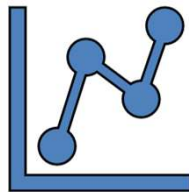
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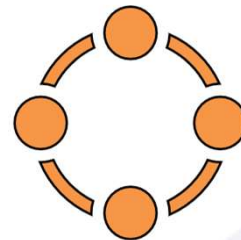
Mathematical modeling of economic models



Axis diagram



Economic model / theory



Economic model: Set of assumptions without logical errors (Hausman, 1992; Hardt, 2017)

Economic laws: not universally valid, can only partly be falsified, have hardly any predictive power (Friebel-Piechotta, 2021)

Model



Reality

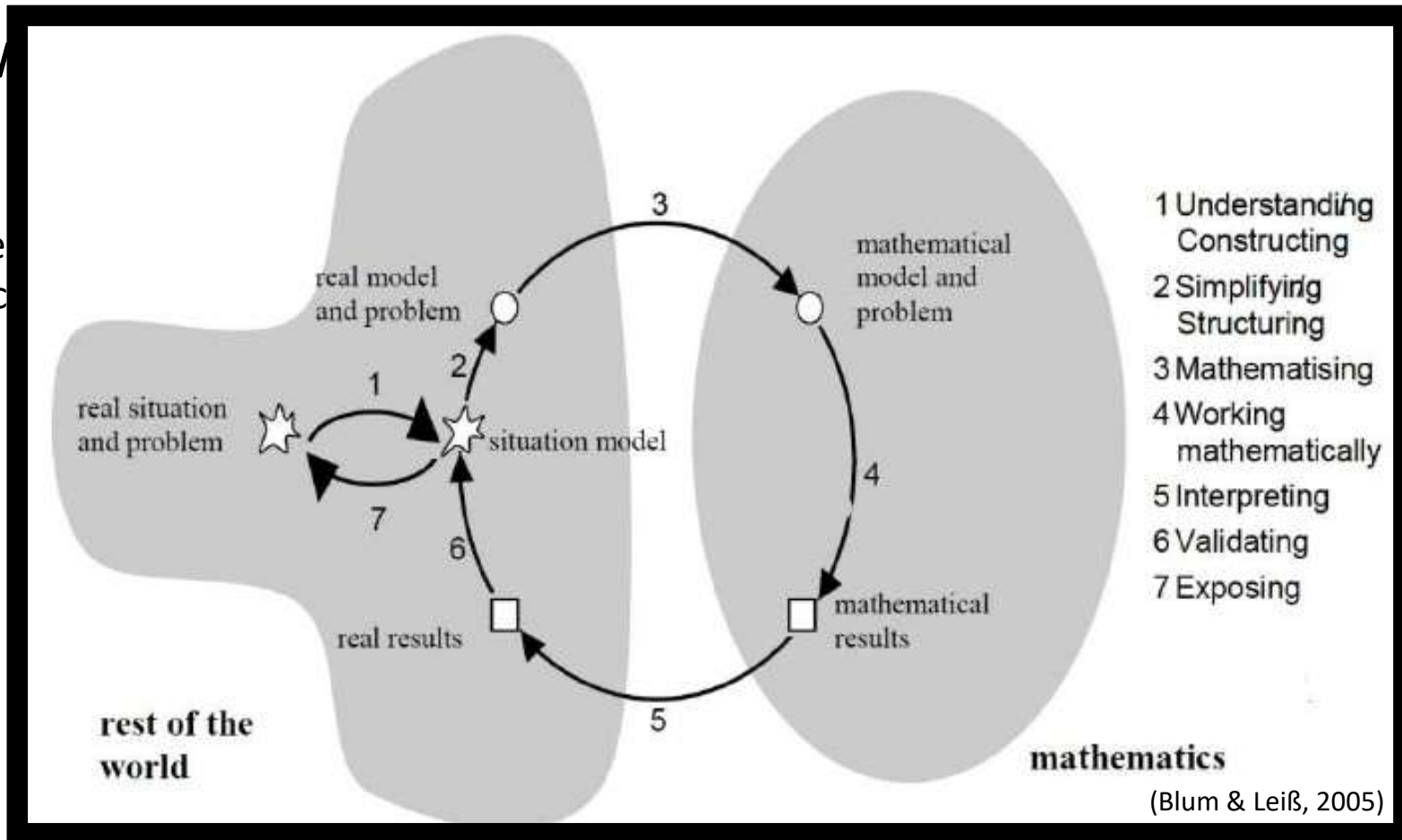


???



"How

Mathematics



Reality



???



The axis diagram as a visualization of mathematical modeling of economic models



Representation form

verbal

symbolic

numeric

graphic

figurative

logical

The law of demand states that the demand for a normal good decreases as its price increases.

Formula:

$$f(x) = -\frac{\Delta p}{\Delta x} * x + t$$

Table of values

Preis (€)	0	1	2
Menge (Stück)	20	18	16

Axis diagram



(Mayrhuber & Leuders & Bruder & Wirtz, 2010; Rolfes, 2018; Schnotz, 2001)



The axis diagram as a visualization of mathematical modeling of economic models



Representation form

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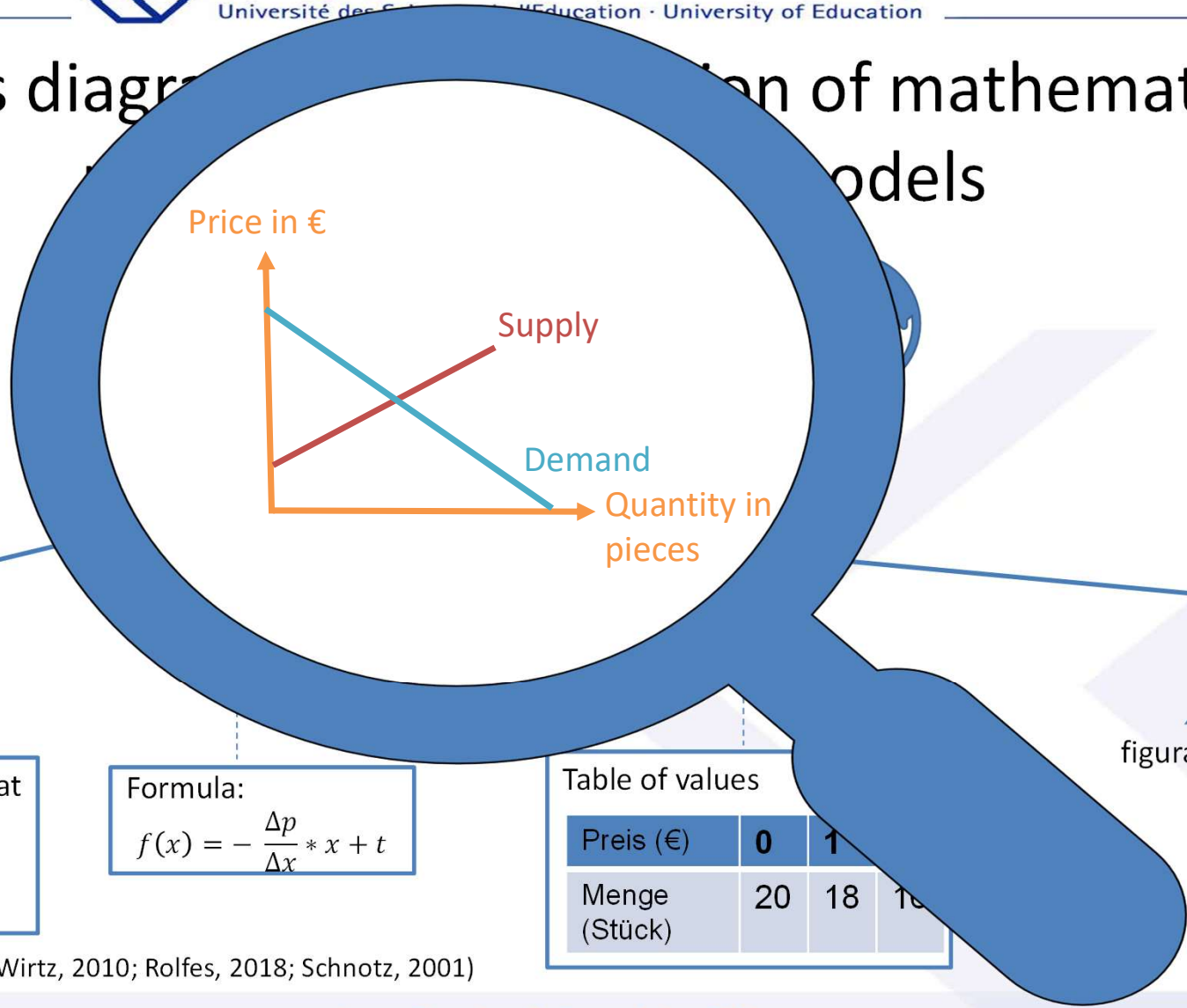
axis diagram



(Mayrhuber & Leuders & Bruder & Wirtz, 2010; Rolfes, 2018; Schnotz, 2001)



The axis diagram as a representation of mathematical models



verbal

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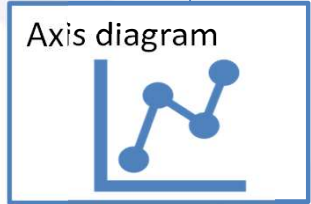
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graphic

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(Mayrhuber & Leuders & Bruder & Wirtz, 2010; Rolfes, 2018; Schnotz, 2001)

Current categorization of student perceptions of the price formation phenomenon

Learning hurdles on the topic of pricing:

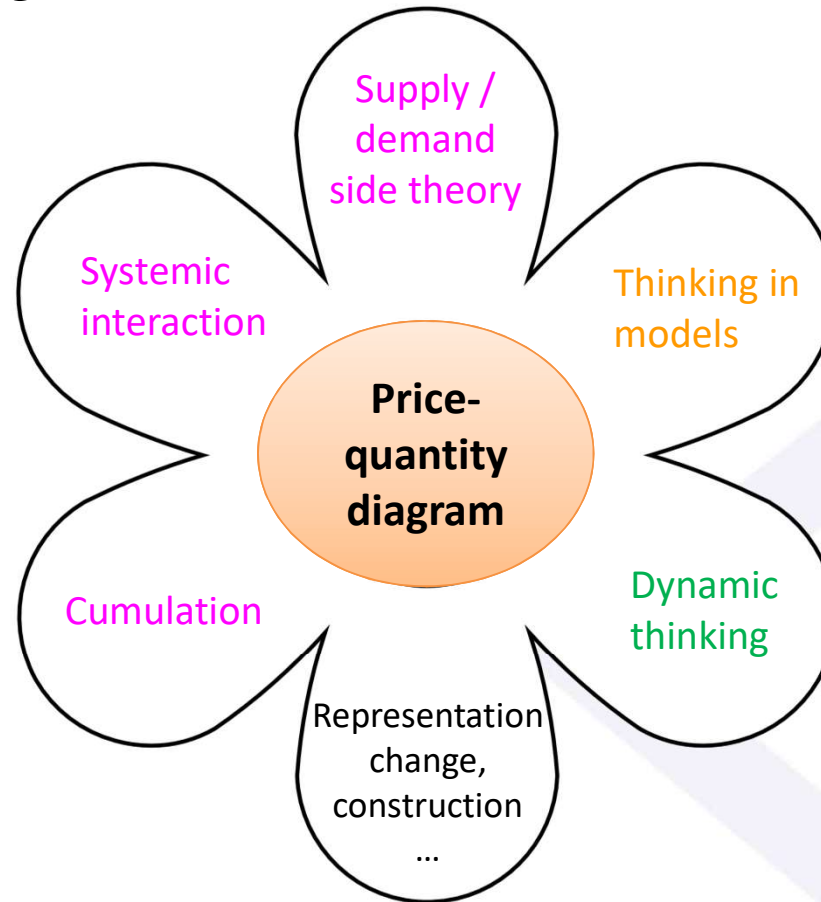
- **1+4+5: Systemic interaction of the supply and demand side in markets** (Furnham & Lewis, 1986, Marton & Pong 2005; Strober & Cook, 1992; Davies, 2011, 2019; Durden, 2018; Jägerskog & Davies & Lundholm, 2019)
- **2 + 3 + 5: Difficulties of students in dealing with economic models, thinking in models and counterintuitive explanations** (Leiser & Shemesh, 2018; Pang & Marton, 2003)
- **Differentiation between short-term and long-term changes / consequences** (Strober & Cook, 1992)

(Jägerskog & Davies & Lundholm, 2019, 93)

	1	2	3	4	5
Dimension	Quantity supplied (Q_s) and demanded (Q_d) (Pang & Marton, 2005)	Slope of demand curve (Pang & Marton, 2003)	Slope of supply curve	Producer or market focus (Davies 2011, 2019 & Durden, 2018)	<i>The causal relationships in pricing</i> (This study)
Causal focus	Q affects Price (P)	P affects Q_d	P affects Q_s	Locus of decision-making affects Q_s	<i>The direction of causation</i>
Categories within dimension	(i) Quantity not mentioned: price reflects quality of product (ii) Change in Q_s affects P (iii) Change in Q_d affects P (iv) Changes in Q_s and Q_d affect P (v) Differences between changes in Q_s and Q_d affect P	(i) No recognition of effect of price on Q_d (ii) Negative effect of price on Q_d (iii) Recognition that the extent to which price affects Q_d may vary.	(i) No recognition of effect of price on Q_s (ii) <i>Negative effect of price on Q_s (implied)</i> (iii) Positive effect of price on Q_s (iv) Recognition that the extent to which price affects Q_s may vary	(i) Prices assumed to be set by individual producers (ii) Market forces determine prices (iii) Competition affects scope that providers have to vary prices in relation to market norm	(i) Q_d affects Q_s (with P not involved) (ii) Q_d/Q_s affects P or P affects Q_d/Q_s (iii) Q_d/Q_s and P mutually affect each other (iv) Q_d , Q_s and P interrelatedly affect each other



Learning hurdles of price formation

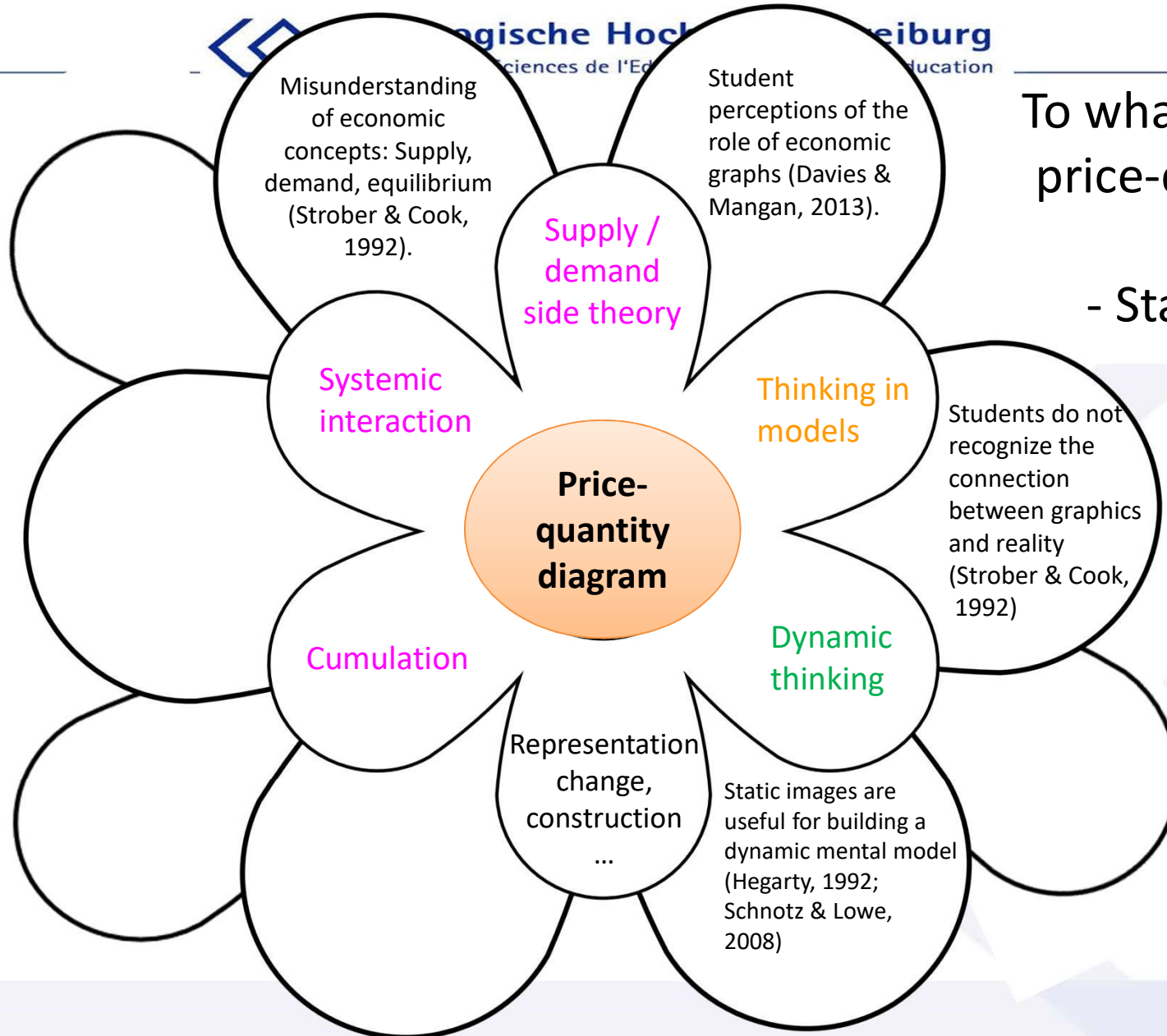


Systemic interaction of the supply and demand side in markets

Difficulties of students in dealing with economic models, thinking in models and counterintuitive explanations

Differentiation between short-term and long-term changes / consequences

(Ossimitz, 2000)



To what extent does the price-quantity diagram help?
- State of research

Axis charts do not promote learning (Cohn et al., 2001; Jägerskog, 2020).

(Ossimitz, 2000)

To what extent does the price-quantity diagram help?

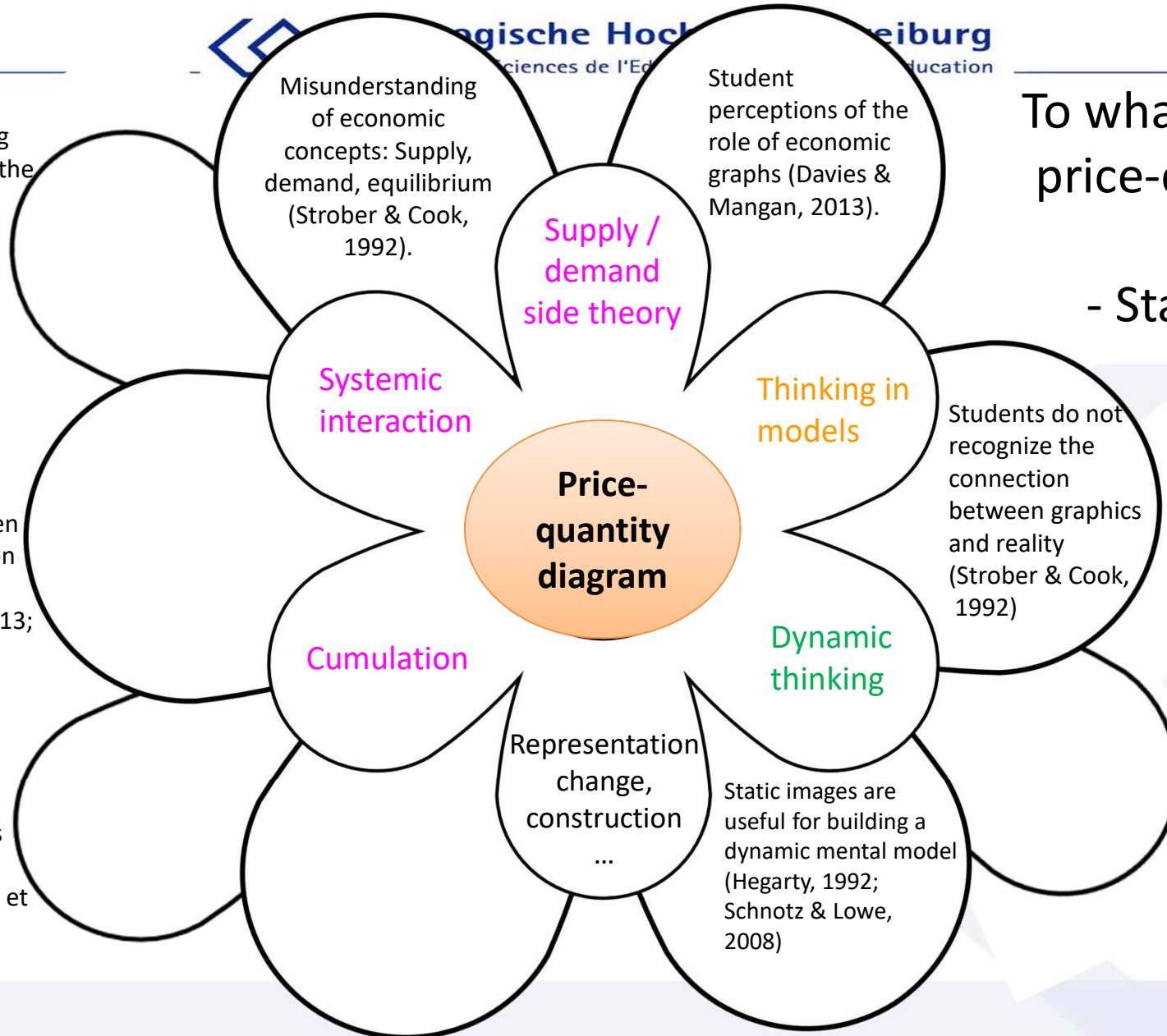
- State of research

Positive correlation between good drawing and understanding of the model (Cohn & Cohn, 1994).

Error pattern of the student error: disregard of the axes (Strober & Cook, 1992).

No correlation between graphic comprehension and economic score (Davies & Mangan, 2013; Brasfield & MC Cow & Milkman, 1992).

Positive correlation between mathematics grade and graphic comprehension (Cohn et al., 2001).



Axis charts do not promote learning (Cohn et al., 2001; Jägerskog, 2020).

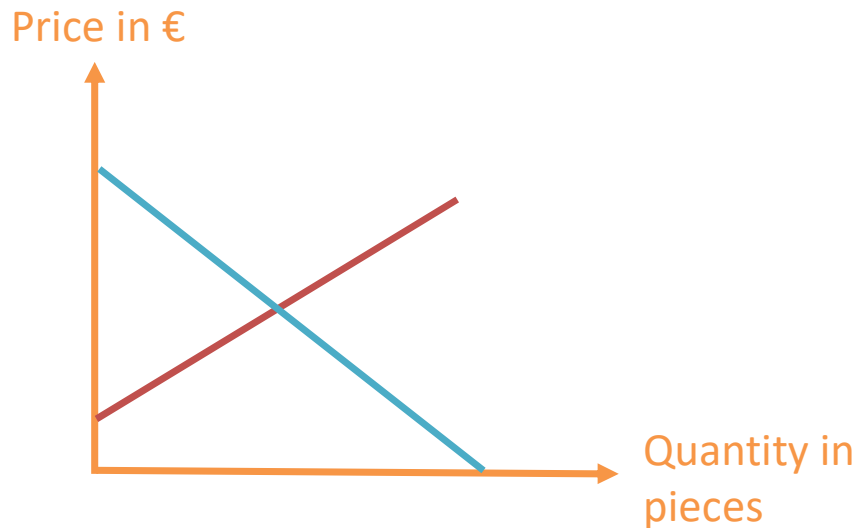
Women have greater difficulty dealing with counts than men (Cohn et al. 2004)

(Ossimitz, 2000)



What is your experience with the price-quantity diagram?

Together with the person sitting next to you, please fill out the following survey about your experience with the price-quantity diagram.

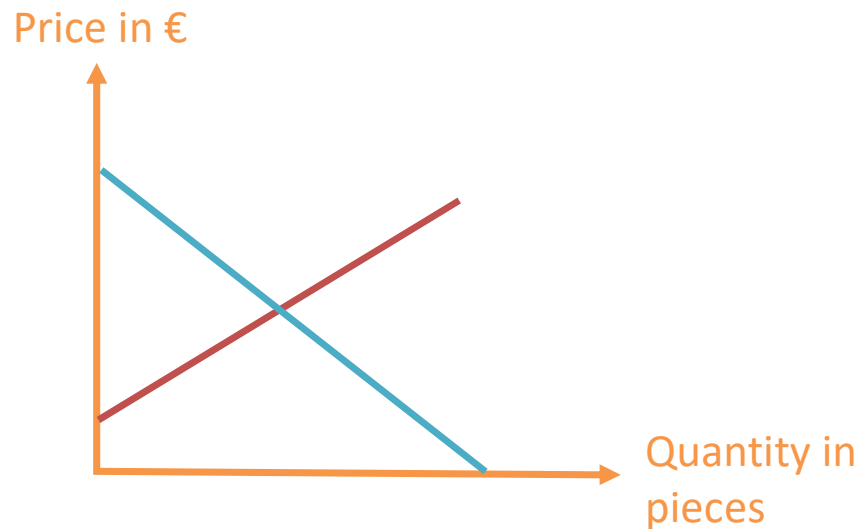


<https://www.umfrageonline.com/s/9f590c4>



What is your experience with the price-quantity diagram?

Together with the person sitting next to you, please fill out the following survey about your experience with the price-quantity diagram.



https://www.umfrageonline.com/?url=result_det&uid=2759134



Thank you for your attention!

We look forward to your feedback.

