

TEACHER TRAINEES CONCEPTIONS OF ECONOMIC POLICY INSTRUMENTS FOR THE ENVIRONMENT

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ABSTRACT

In economics as well as environmental policy, Economic policy instruments for the environment (EPI) are typical and widely used measures to address ecological problems. However, very little is known about teaching and learning EPIs. This paper investigates qualitatively different ways in which teacher trainees of Economics in two German universities assess typical EPIs and compares them to disciplinary criteria. Data has been gained in group discussions. The paper applies the phenomenographic and documentary method. Teacher trainees' conceptions are found to only partially represent means-end-relations typical for Economics. Furthermore, important differences between teacher trainees' conceptions are found depending on the scenario used and the instrument they are evaluating. Based on teacher trainees' preconceptions and a comprehensive literature review of the relevant research from Ecological, Environmental and Behavioural Economics, I derive implications for teaching, primarily for teachers, but adaptable to suit for other students as well.

Keywords: Phenomenography, Curriculum research, Economic Education, University Teaching and Learning, Teacher Education, Ecological Economics, Environmental Economics.

INTRODUCTION

Economic policy instruments for the environment (EPI) play a crucial role in international and national environmental policy, e.g. subsidizing renewable energies (IRENA, 2012), fuel taxes (Stern, 2007) or emission trading schemes (European Parliament and the Council of the European Union, 2003, 2009) as well as in research in Ecological and Environmental Economics (Castro e Silva & Teixeira, 2011; Hoepner, Kant, Scholtens, & Yu, 2012; Ma & Stern, 2006). Being able to understand and critically assess such central policies is important for citizens in order to be able to participate in the shaping of democratic societies. However, so far, there has been little conceptual research in economic education concerning the environment (Seeber & Birke, 2011). In addition, the existing research on Environmental and Ecological economic education does not take the results of research in behavioural economics into account and is mainly focused on explaining ecological problems. However, Education for Sustainable Development strives to enable learners to shape sustainable societies (De Haan, 2006). To address existing gaps, the first aim of this paper is to determine core elements from Ecological and Environmental Economics on EPIs which should be covered in economic education.

Also empirically, only few studies in economic education have covered sustainability related topics. Green (2012 & 2013) reports textbook analysis and interviews with students documenting that introductory economics courses and textbooks place little emphasis on the environment and sustainability. Andersson, Öhman, & Östman (2011) describe four different ways in which moral responsibility in relation to the role of a business person is portrayed in

textbooks for International Economics. Davies, Howie, Mangan, & Telhaj (2002) report that British students lack knowledge concerning economic environmental policy. Davies & Lundholm (2012) discover different students' conceptions regarding the question whether goods should be provided for free. They range from a simple recognition that some goods are provided for free up to a desire to set incentives to internalize externalities. Harring, Davies & Lundholm (2017) find that after having studied one semester economics, Swedish students become slightly more likely to evaluate economic policy instruments for the environment (taxes and subsidies) as good and efficient, and less likely to consider regulatory and informational instruments as good and efficient. Interestingly, this result is independent of whether students improved their economic knowledge. Ignell, Davies, & Lundholm (2017), as well as David Löw Beer (2016a) focus on students' conceptions regarding externalities. Both find that most of the students want environment-friendly products to be cheaper than other products. Ignell, Davies & Lundholm (2017) additionally point out that students focus more on the supply than on the demand side when arguing why ecological goods are more expensive. David Löw Beer (2016a) finds that the vast majority of the teacher trainees interviewed does not specifically connect the price adjustments to the ecological harms or benefits of products. David Löw Beer (2018) analyses students' conceptions on Ecosystem Assessment and Valuation (ESAV) and finds that students tend to see nature as a place for recreation and wildlife, do not see knowledge as uncertain and hardly bring up the idea of an economic valuation. Furthermore, Ignell, Davies, & Lundholm (2013) discovers that students are very selective concerning the goods they consider environmentally harmful and that their perceptions often differ from scientific considerations. Studying students in Chinese Green Schools, Sternäng & Lundholm (2012) conclude that the students in the sample believe that environmental problems are unavoidable when developing an economy. They do not see environmental protection and economic growth as conflicting objectives. Finally, Lundholm (2007) reports that ten of the eleven students entering a masters course in Sustainable Enterprising in Sweden describe the idea of pricing nature as difficult, insufficient or even dangerous.

To the best of my knowledge, there is no thorough conceptual and empirical research on how to teach, and learn, about EPIs and their evaluation. Studying the different ways in which people evaluate public policy is highly relevant, because the choice of appropriate policies depends on the value criteria used and because governments continuously struggle with setting priorities between economic, ecologic, and social objectives. The second objective of this paper is to address this research gap. It reports different conceptions from group discussions with 69 teacher trainees' in two German universities. Teacher trainees were asked to suggest and evaluate policy measures to support ecologically beneficial technologies or to limit emissions.

The remainder of the paper is organized as follows: The next section describes the research approach phenomenography and explains why it has been selected. The third section depicts and justifies how data was gathered and analysed. After that, I provide an exemplary answer to one of the scenarios used in the group discussions based on recent research from Ecological, Environmental and Behavioural Economics. Then, I present and discuss conceptions on how to evaluate EPIs. In the conclusion, I suggest how the results can be used in teaching.

METHODOLOGY: PHENOMENOGRAPHY AND VARIATION THEORY

Studying learners' pre-conceptions has become a well-established part of subject didactics, especially in science education (Vosniadou, 2010, 2013). Particularly in social sciences, the argument for this type of research is connected to the goal to teach complex

concepts as functioning democratic societies need an electorate which can participate because it understands relevant economic, political and social dynamics (Davies, 2006; Davies & Lundholm, 2012). To improve students' acquisition of complex threshold concepts (Meyer & Land, 2003; 2006) and as pre-conceptions can support or constrain learning, teachers need to know about the different conceptions of students prior to a learning process (Carretero & Voss, 1994).

One approach to study preconceptions is phenomenography. I chose it here for two reasons: (1) It is only based on learners' experiences and does not infer the quality of their mental representations (Marton & Pang, 2008). (2) Furthermore, relating preconceptions to scientific models is a common strategy in phenomenography and an objective of this paper.

Phenomenographic research in economic education has so far focused on (a) the concepts of price (Dahlgren & Marton, 1978; Marton & Pong, 2005; Pang, Linder, & Fraser, 2006; Pong, 1999), trade (Marton & Pong, 2005; Pong, 1999) wages (Birke & Seeber, 2014), externalities (Ignell, Davies & Lundholm 2017; David Löw Beer, 2016a) and Ecosystem Valuation and Assessment (David Löw Beer, 2018) (b) an economic competency such as financial literacy (Pang, 2010; Speer & Seeber, 2013) or (c) on describing normatively different conceptions of how an economic problem should be solved, such as which goods should be provided for free (Davies & Lundholm, 2012) or when governments should intervene (Kaiser, Birke, & Lutter, 2015). The present study is similar to (a) as it also focuses on conceptions related to a technical concept.

The object of research in phenomenography is the "qualitatively different ways in which people experience, understand, see or conceptualize a particular phenomenon or an aspect of the world around them" (Marton & Pong, 2005). Phenomenography aims to create outcome spaces with categories of description. These categories or conceptions are supposed to represent the different ways of experiencing a phenomenon within a group. They are logically interrelated and in all phenomenographic studies conducted so far, there has been a small and limited number of different ways of experiencing (Marton & Pang, 2008). Phenomenography takes a second order perspective focusing not on how phenomena really are, but on how they are experienced by certain people. An important term in the recent versions of phenomenography is critical aspects. An aspect or a feature is defined critical if it must be understood to unlock the meaning of a concept, but has not yet been understood by the learner (Marton, 2015). Critical aspects can only be found by studying the discipline and the learners together.

To provide an example of a typical result from a phenomenographic inquiry and to explain further terms, which will be important in the outcome spaces in the results and discussion sections, I sum up the price conceptions described in Marton & Pong (2005). They have asked 40 Canadian high school students to argue on questions such as, why a Coke is more expensive in a hotel lobby than in the school's machine. Marton & Pong differentiate between a structural aspect the features discerned and focused by an individual and a referential aspect the meaning of an object. They discover students' conceptions on three levels. Table 1 summarizes the conceptions. Because of the hierarchical structure, the third conception includes the conceptions on the second level and is therefore considered more complex.

Knowing about different conceptions can be helpful to design effective lessons. These usually begin with learners' preconceptions and allow them to advance towards a scientifically appropriate way of understanding. As it has proven to be very difficult to "eradicate preconceptions" (Duit, Treagust, & Widodo, 2013), the goal is to enlarge students' preconceptions.

Variation theory is used for teaching processes based on phenomenographic inquiries. It includes first varying one critical aspect of a learning object after another (e.g. first separate variations in demand and then in supply conditions, if the supply and demand concept is the learning objective). Secondly, non-defining aspects are varied (e.g. emphasizing the different sizes of objects and its possible connection to their prices). Thirdly, learners experience a joint variation of different critical aspects (Marton, Runesson, & Tsui, 2004). Focus is put on the elements that students do not know prior to a learning process. Empirical evidence demonstrates strong learning effects of variation theory (Lo, Marton, Pang & Pong, 2004; Marton, 2015; Marton & Pang, 2013).

Conception	Level	Referential Aspect	Structural Aspect
A	1	Price reflects the <i>value of the object</i> concerned	Focused on the <i>characteristics</i> of the object in question
B	2	Price is related to the <i>demand conditions</i> of the market	Focused on the <i>people who buy</i> such objects
C	2	Price is related to the <i>supply conditions</i> of the market in which the object is situated	Focused on the <i>people who sell</i> such objects, or the <i>places where they are sold</i>
D	3	Price is related to the <i>opposing demand and supply conditions</i> of the market in which the object is situated	Focused on both <i>people who buy and people who sell such objects</i> (or <i>places where they are sold</i>) simultaneously

Source: Marton and Pong (2005)

RESEARCH DESIGN

To study learners' preconceptions in ecological-economic situations, group discussions with teacher trainees in economics have been conducted. Teacher trainees were chosen as a research group for two reasons. First, as EPIs and valuation criteria are rather advanced concepts in economics, it is necessary to first think of ways to make them (more) accessible to teachers before they can then convey them to high school students. Secondly, designing good learning environments for teachers is important, as they are prospective multipliers.

Most phenomenographic research so far has used individual interviews or texts written by individuals. However, I opted for group discussions as method of data collection as they are useful for studying normative questions (Mangold, 1960) and as learners confronted with complex questions are often only capable to develop their own ideas while discussing with others (Pollock, 1955). As phenomenography does not research individual conceptions, but focusses on the "collective mind" (Marton, 1981), it seems reasonable to work with group discussions. Based on group discussion, one can survey ideologies, opinions and attitudes, which are typical for a certain type of groups and which therefore, can be reproduced (Bohnsack, 2004 & Lamnek, 2005). A common critique to group discussions is the mutual interference of participants. For two reasons, this is not considered to be a problem in the present paper: (1) Many learning processes take part in groups. Therefore it makes sense to research groups in order to suggest improved teaching and learning environments. (2) Phenomenographic research does not aim to

reach any conclusions regarding individual conceptions, but focuses on the “collective mind” (Marton, 1981). As a methodological consequence, the smallest unit of people analyzed, is one focus group.

It is important to note that comments made in a group discussion may not be traced to an individual participant because one cannot know whether the participant would have made the same comment in an individual interview (Bohnsack, 2010). Hence, the following analysis at all times refers to groups or to comments made within a group.

The research objective has been to discover a large range of conceptions within the research group of teacher trainees in Germany. Therefore, I have selected a diverse sample. In total, sixteen group discussions were led with a total of 69 teacher trainees in economics in November and December 2013. With Oldenburg and Landau, I have chosen two different German universities: In Oldenburg, there is an integrated course of economic education. In contrast, in Landau, students of economic education participate in the regular economics courses for their disciplinary training. Furthermore, teacher trainees differ regarding the time they have studied economic education. Ten groups comprised of teacher trainees beginning their bachelor studies, five groups were at the end of their bachelor or at the beginning of their master studies, one group was mixed. The group discussions lasted roughly between one and two hours. To recruit the students, I went to lectures and seminars of economic education. The students participated voluntarily. Technically speaking, I used purposeful sampling (Coyne, 1997).

In each group, two types of scenarios were used. The first type of scenarios was more open, i.e. students were asked to develop their own ideas for possible measures and evaluate them. The second type was more closed, i.e. students were mainly asked to evaluate a set of given EPIs. The first type of scenarios comprises of a set of four scenarios. Teacher trainees were asked to develop ideas how to regulate an environmentally harmful human activity or to support an environmentally beneficial technology. During the discussions, I have asked the teacher trainees to evaluate the ideas brought up by others. The intention has been not to focus on the question whether ecological aspects should be considered at all in personal, entrepreneurial or political decisions, but rather on which measures could be taken and to which extent. The stimuli deal with emissions in air traffic, emissions in general, the promotion of solar paint and of organic food.

In the second type of scenarios, participants were requested to comment on five typical instruments of Environmental and Ecological Economics (Engaging the public, direct environmental regulation, taxes/levies, subsidizes, and emission permit schemes). An example for a stimulus of the second type is:

As you probably know, environmentally harmful emissions arise out of aviation. What do you think of the following measures to limit emissions in aviation? In case, you have ideas on how to improve these measures, you are, of course, welcome to express them as well.

1. *Through an information campaign, the population is informed about the negative consequences to climate change due to aviation and about more ecological alternatives.*
2. *Flying will be prohibited on routes on which railways need less than six hours.*
3. *The airport tax, which every traveller has to pay, will be increased.*
4. *The taxes on jet fuel or kerosene will be increased.*
5. *The airline companies will be obliged to buy CO₂ tradable emission permits: For every ton of CO₂, which they emit, they will have to buy such a permit. The number of available permits will be reduced every year.*

All stimuli are presented in the appendix. The group discussions have been fully transcribed and analysed using the phenomenographic (Marton, 2015) as well as the documentary method (Bohnsack, Nentwig Gesemann, & Nohl, 2013). The analysis was based on an iterative process of working through the transcripts. A random selection of six transcripts was analysed by a detailed examination of every single sequence with a formulating (very close to the statements, focusing on the immanent meaning) and a reflecting (more interpretation, connections to the technical concept are drawn) interpretation (Bohnsack, 2010). This led to a set of different categories. In the second step, these categories were used to code all transcripts. Extensions and corrections were made where necessary. The first step of the coding process focused on differences between the units of analysis, i.e. statements by participants. Then, the material was analysed for similarities with the goal of a generalization. Finally, logical relations between the units were identified (Marton, 2015). In this process, data have been analysed using the qualitative data software MAXQDA 11. As communicative validity checks (Marton & Booth, 1997; Sandbergh, 1997), preliminary outcome spaces have been presented at scientific conferences and two other scientists have been asked to code a randomly selected transcript based on our set of categories. Minor differences could be resolved dialogically.

PERSPECTIVES FROM ECOLOGICAL, ENVIRONMENTAL AND BEHAVIORAL ECONOMICS

Before analysing teacher trainees' conceptions, I provide an exemplary answer to the scenario from a disciplinary perspective. Thereby, firstly disciplinary research is brought together in a new way for teaching and learning. Secondly, terms are introduced which will also be used to structure teacher trainees' conceptions. Thirdly, I provide a (partial) description of what should be learned about EPIs from a disciplinary perspective. However, to avoid confusions: As the conclusion will detail, teaching and learning should not be restricted to what is considered important in the discipline. For a detailed suggestion of what should be covered in Economics' Education on EPI, please refer to David Löw Beer (2016b).

For the disciplinary answer a structuring content analysis (Mayring, 2014) has been conducted. The main material covered for the analysis were ...

- ... all publications on sustainability in economic education (Seeber & Birke (2011) provide a good summary. Newer texts were added, most of them are referred to in the introduction),
- popular textbooks of Ecological Economics (Common & Stagl, 2005; Daly & Farley, 2010; Edward Jones, Davies, & Hussain, 2004) and Environmental Economics/policy instruments for the environment (Perman, Ma, Common, Maddison & McGilvray, 2011; Sterner, 2003; Tietenberg & Lewis, 2016),
- ... the most cited articles dealing with principles or policy articles according to bibliometric (Castro e Silva & Teixeira, 2011) and citation analysis (Hoepner, Kant, Scholtens, & Yu, 2012; Ma & Stern, 2006) from Ecological and Environmental Economics,
- ... the 50 most cited or most relevant papers with the search terms "environment" and "policy instruments" according to Web of Science and Google Scholar,
- ... current research on behavioral economics related to EPIs. Literature selection here has been guided by the surveys of Carlsson and Johansson-Stenman (2012); Gintis (2000); Gowdy (2007, 2008, 2010); Johansson-Stenman and Martinsson (2006); Nyborg (2010) and Shogren and Taylor (2008) and
- selected economic research on air traffic related to topics such as ecologic problems, externalities in transport or price elasticities.

Firstly, an Economic approach would analyze the pollutant to be regulated. The scenario on air traffic focuses on (greenhouse gas) emissions. They predominantly mix uniformly, so that regulation can mainly focus on the overall amount of emissions and less on the emission of an individual source.

Secondly, the different EPIs suggested would be analysed based on criteria. The first goal in Ecological Economics is a sustainable scale, i.e. a “flow of matter-energy from the environment as low-entropy raw materials, and back to the environment as high-entropy wastes“, which does not erode environmental carrying capacity over time (Daly, 1992). Secondly, it involves a just distribution of the available resources. What is considered just, cannot be determined by science, but has to be decided by society. Thirdly it involves efficiency which is linked in Ecological Economics to the desire to reach the highest possible quality of life with the given resources (ibid.). The main focus in Environmental Economics is efficiency, which is defined in a different way compared to Ecological Economics. Static efficiency or cost-effectiveness in Environmental Economics is connected to the objective to reach a goal at least cost. Dynamic efficiency focuses on the incentives for an ecologically desirable, technological progress. In the following, I will refer to the Environmental Economics concept when talking about efficiency, because it is more commonly applied. A further goal in Environmental Economics is accuracy, evaluating how certain one can be to attain a desired target. This is related to the sustainable scale goal from Ecological Economics, but does not mandate to check whether attaining the goal would lead to ecological sustainability.

The first measure (information about the adverse effects of flying) is probably not going to reduce emissions strongly, because the aviation sector contains many suppliers and demanders. While reducing the amount of flying is a high burden for an individual, her flying behaviour has only a negligible effect on the climate, so that she has little incentives to change (free rider behaviour). Besides of the poor chances to reach a desired emission target, information measures are generally considered to be relatively inefficient, because they are expensive compared to their potential to reduce emissions (cf. for one of the rare empirical studies ÖkoInstitut e.V, Consult, Berlin, Institut, Köln, & Ziesing 2012). Some studies, however, suggest that one can reach a fairly substantial amount of emission reduction, if information measures are designed comparing individual consumption to that of others (Allcott, 2011; Ferraro, Miranda, & Price, 2011; Ito, Ida, & Tanaka, 2015; Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007). Furthermore, it might be worthwhile considering an information measure which enables business class passenger to publicly display the flights they have not taken: Studies suggest that they change their behaviour significantly less than economy class passenger because of price adjustments (for a meta-analysis on price elasticity's in the aviation sector cf. Brons, Pels, Nijkamp, & Rietveld, 2002). There is not enough research to assess the effects of an information measure on dynamic efficiency and distribution.

A direct environmental regulation (second suggestion) cannot be circumvented in case of a functioning statehood. This is likely to also lead to a reduction in emissions, however there is still a lack of sound empirical evidence to understand what people would do to substitute flights (Anger & Köhler, 2010), if they were prohibited. A ban equally prevents everybody from flying. This can be considered just for equality reasons or unfair, because it also inhibits those people to fly who would be willing to pay a high price. As the suggested ban interdicts flying for people independent of their willingness to pay, it is less efficient than other measures. Furthermore, it does not incentivize technological progress, because it does not depend on the specific emissions of an individual aircraft.

An increased airport tax (3rd proposal) should lead to higher airfares. Empirical studies show that this should reduce the number of flights (Brons, Pels, Nijkamp & Rietveld 2002; Deutscher, Bundestag, 2012) and emissions. However, the uncertainty about substitution effects applies here as well. Studies show that there are externalities in aviation which are not priced in (e.g. Ricardo A. E. A., 2014). Therefore increased airfares result in an approximation of demand towards a societal optimum. Nonetheless, the cost-effectiveness of an increased airport tax is low to mediocre, because it does not provide incentives to select cheap abatement technologies. Similarly, the dynamic efficiency of an increased air tax is low, because it does not create incentives to invest in low-emission technologies.

A higher kerosene tax (4th proposal) should similarly lead to higher airfare and less passenger and cargo transport. Furthermore, contrary to the 3rd proposal, it creates an incentive to reduce the amount of fuel used. Nonetheless, a kerosene tax does not have a high accuracy, because of possible substitution effects. The accuracy could be improved by introducing a carbon tax which would be levied on any fuel. The cost-effectiveness and dynamic efficiency of a kerosene tax are high, because it incentivizes relatively cheap strategies to protect the environment and to continually invest in low-emission technologies.

By defining the amount of emission allowances (last proposal), an emission target can be reached precisely. Nonetheless, as proposed here, emission allowances do not have a high accuracy, because of possible substitution effects. The accuracy could be improved by including all sources in an emission trading system. A general emission trading system is efficient for the same reasons as a kerosene tax. However, if trading is limited to the aviation sector, there is a higher risk that some companies buy up certificates in order to eliminate competitors which would jeopardize the desired cost-effective environmental protection.

Looking at the distributional effects, proposals three to five are likely to affect people with lower incomes to a larger extent, because of the law of diminishing marginal utility (Gossen, 1983), i.e. they will suffer more from an increased price as the same amount of money is “worth more” to them and they are more likely to (be forced to) renounce from a flight.

All in all, out of the proposals presented, a kerosene tax is the preferred choice from an Environmental Economics perspective. From an Ecological Economics perspective, the answer is less clear, but there is a tendency to prefer emission trading systems, because they (theoretically) allow to precisely set ecological targets.

RESULTS

During the first iterations through the data 51 different criteria to evaluate environmental policy measures were identified. Through mergers and abstractions, these could be consolidated to 17 (please contact the author to receive a list of the original categories). To make the outcome space more accessible, they were organized in an economic, an ecological, a social dimension and further criteria.

Economic Dimension

Statements describing the monetary impacts to consumers, enterprises or the government were categorized as *costs to individual groups*. Typical terms used here were “expensive”, “cheap”, “afford”, “save”, “expenses” or “revenues”. The following exemplary quote involves the participant herself in her role as a consumer, others address consumers in general, I5: “Ultimately, flying would become more expensive for me, if airbus had to comply with all these

things” (O A 2, II.2. air traffic, 50) (The letter I in front of the quotes stands for interviewee, all interviewees were numbered. At the end of the quote L stands for Landau and O for Oldenburg as the locations of the group discussion, thereafter B stands for beginners, A for advanced students. This is followed by the number of the group discussion in the respective category. Then the topic of the group discussion is named (compare Appendix for all scenarios). Finally, the page of the transcript is given. For example, the above quote comes from interviewee 5. He or she was part of the second group of advanced students in Oldenburg. The discussion quoted covers the air traffic scenario and the original quote can be found on page 63 of the (German) transcript. The full original transcripts can be obtained by contacting the author).

Instruments were also evaluated by their *incentives to change behaviour*. Terms like “stimulate” or “incentive” were typical. An example related to an educational instrument is, I66: “I am not sure, whether education works. I think of 9th-graders, you tell them: Plastic bags are shit und you explain that to them. They look at each other and say: Yeah, whatever. And then they go to the next grocery store and get a plastic bag.” (L B 7, II.1 emissions, 351)

If costs to individual groups were considered in relation to the induced behavioural changes, statements were categorized as *weighing of costs and benefits*. An example is this quote, I57: The state itself has to consider, what is more valuable: Do I invest in this idea of paint? It’s a pretty nice idea, but is it worth it? Or can one possibly advance it, so that it really is an alternative to solar?” (L B 5, II.1 solar paint, 319)

Furthermore statements which did not consider individual groups, but consequences related to jobs or sectors, were categorized *overall economic situation*. Finally, instruments were evaluated economically by judging their *incentives for technological progress*.

Ecological Dimension

Statements categorized as *ecological improvement or deterioration* depict the capacity of an instrument to reduce emissions. Theoretically one could imagine statements judging the benefits of expanding an environmentally-friendly technology, but no such statement was found in the data. A commonly used term is “emissions”. The following quote refers to an offsetting scheme. I28: “So that people can appease their bad conscience.” I27: “This does not reduce emissions. It sounds more like marketing.” (O mix, II.1 air traffic, 168).

In addition, there is a single statement in the data evaluating an instrument by its *attainment of an ecological objective*, I36: “A trading scheme has the advantage that you can say: What is my emission target, how much is currently emitted and then step-by-step, I will only is-sue so many of them, that I will get closer and closer to the emission target.” (LA 2, II.2 air traffic, 236)

Social Dimension

The few statements judging instruments based on social criteria, have been categorized as *justice*. They evaluate a measure based on the question, whether it is just or not or whether individual groups are disadvantaged or advantaged. Widely used terms were “poor”, “afford” or “able to pay”, like in the following statement. B7: “But it would be stupid for [financially] poor students who could not afford a flight.” (OA 2, II.2 Air traffic, 53)

Other Criteria

Furthermore, participants evaluated measures depending on their political feasibility, their impact on individual freedoms, ethical justification, whether it is possible to control their impact and with reference to practical reservations, which refers mainly to the aesthetic and risk aspects of solar paint.

Table 2 depicts, in how many groups the different categories have been used in total and depending on the respective scenario.

		Total	Emissions in general	Scenarios Type I		Organic food	Scenarios Type II	
				Solar paint	Emissions in air traffic		Solar paint	Air traffic
Economic	Costs to individual groups	97%	100%	100%	80%	100%	100%	100%
	Incentives to change behaviour	91%	75%	67%	100%	100%	89%	100%
	Weighing of costs and benefits	34%	0%	67%	40%	25%	44%	29%
	Overall economic situation	31%	0%	33%	60%	0%	33%	43%
	Incentives for technological progress	50%	0%	33%	80%	0%	67%	71%
Ecological	Ecological improvement/deterioration	38%	0%	0%	100%	0%	44%	43%
	Ecological attainment	3%	0%	0%	0%	0%	0%	14%
Social	Justice	41%	50%	33%	40%	75%	33%	29%
Other	Feasibility	53%	50%	33%	80%	75%	22%	71%
	Individual freedom	22%	0%	0%	60%	25%	11%	29%
	Ethical justification	44%	0%	0%	20%	50%	78%	57%
	Control	16%	0%	0%	20%	50%	11%	14%
	Practical reservations	59%	25%	67%	100%	25%	78%	43%

Interestingly, there were only minor differences between the groups with beginner and advanced students and between the groups in Oldenburg and Landau. More specifically, I could

find most of the conceptions slightly more often in the advanced groups. However, regarding the conceptions which are more complex or closer to a disciplinary approach (“weighing of costs and benefits” and “incentives for technological progress”), there was no difference between the frequencies in the beginner and advanced groups.

Frequencies are based on counting in how many discussions a respective category was used at least once. Because of the qualitative nature of the study and the data collection through group discussions, there was no differentiation whether a category had been assigned several times or only once during a single group discussion.

DISCUSSION

Qualitative Differences between the Criteria and Comparison with Economics

Most assessment conceptions in the economic dimension either refer to ends, i.e. the incentives a measure creates to change behaviour in a desired way *or* to the costs which certain groups have to bear because of the application of an instrument. In contrast, the more complex criterion of weighing costs and benefits jointly looks at ends *and* means. When comparing those three criteria, one can observe an increasing complexity as the more complex concept includes aspects of the less complex ones. Furthermore weighing costs and benefits is similar to the economic criterion of cost-effectiveness which evaluates whether an instrument can reach a goal at low costs.

Using the increasing complexity, one can put the different conceptions on a hierarchy. On the first level of complexity, there are two conceptions. The conception on the higher level of complexity combines the two on the lower level. Table 3 illustrates the connection. The conceptions of costs to individual groups and incentives for behavioural change are presented as partial concepts of the more complex conception of weighing costs and benefits. As table 2 indicates, both criteria on the first level of complexity can be found in almost all (31 or 30 of 32) group discussions, while the more complex concept is brought up in every third discussion only.

Level of complexity	Conception	
I	Costs to individual groups (consumers, enterprises, government)	Incentive to change behavior
II	Weighing of costs and benefits	

Furthermore, many teacher trainees have argued from personal experience, whereas economics typically takes the perspective of markets or social planners. Thereby, the teacher trainees have difficulties to understand the functioning, benefits and shortcoming of markets similarly to the discipline.

In the ecological dimension, the concept of ecological improvement/deterioration indicates that the participants consider environmental impacts. The conception of ecological attainment is more complex as it additionally compares the ecological impact to a goal. It is similar to an Environmental Economics way of relating means and ends. Ecological Economics additionally demands that measures should be evaluated depending on their capacity to limit the environmental impact to what is sustainable for an ecosystem. However, statements related to

this scale criterion (see section on perspectives) could not be found in the data.

While the relatively few statements refereeing to ecological criteria (see table 2) can be partially explained by the fact that the goal of an ecological improvement has already been mentioned in the scenarios themselves, it is surprising that none of the groups discussed a specific ecological goal (e.g. “reducing emissions by X %” or “to a sustainable level”).

The controversial evaluation concerning the question whether the instruments are just, mirrors debates in Economics. However, the participants have been primarily concerned identifying groups which might be excluded from consumption due to a measure and to evaluate whether they would consider this ethically acceptable. In contrast, economics is typically more concerned to display distributional effects in general.

Similar to other research in phenomenography, I find hierarchical relations between the conceptions in the ecologic, economic and social dimension. The conceptions considered more complex always include the relevant aspects of the less complex conceptions and add an additional aspect or unite aspects of two conceptions.

Across all dimension, it is noteworthy that the participants mostly argue from a consumer perspective, e.g. by looking at costs and incentives to consumers rather than companies and the government or by putting a large emphasis on practical reservations such as aesthetics or technology. Only few use the perspective of a social planner or the government, which is typical for Environmental and Ecological Economics. This may partially explain why only few groups referred to means-end-relations.

Intercontextual Shifts

The groups have used criteria common in Economics (such as weighing costs and benefits and incentives for technological progress) more frequently in the air traffic scenario. In the other scenarios they were more concerned to comment on their personal preferences.

The more frequent use of ecological criteria in the air traffic example might be due to the fact that an emission reduction is already aimed for in the scenario. Therefore, it might have been easier for teacher trainees to connect to ecological impacts compared to the scenarios which aim to support an ecologically beneficial technology (organic food or solar paint), but which do not explicitly mention the ecological problems of a specific products.

The justice criterion is used more frequently in the organic food scenario which might be due to the fact that food is a basic human need (as opposed to solar paint and flights). Furthermore, recent scandals related to harmful substances in food might explain why the criterion of control options has been mentioned more often in this scenario.

Criteria Use Depending On Instrument

In Economics, the same value criteria are used to evaluate all instruments. This enables a comparison. Analysing which criteria learners use depending on the instrument they evaluate has important implications for instruction as it allows to focus teaching on critical aspects.

The columns in table 4 display the most important instruments brought up by the teacher trainees using terms from Environmental and Ecological Economics whenever feasible. The criteria are shown in the lines.

The participants evaluate measures engaging the public mainly referring to their

incentives to change behaviour (mentioned in 50% of the discussions, see table 4). Similar to Economics, most groups criticize measures engaging the public for their low incentives to change behaviour. However, while Economics focuses on the high costs of measures engaging the public relative to the low impact (i.e. high CO₂-abatement costs), teacher trainees focus on absolute costs. Furthermore, while experiments in behavioural Economics indicate that instruments engaging the public can have an impact, if individual behaviour is put into perspective with a comparison group, the groups rather put their hope on behavioural change by displaying the negative ecological impact of an action, e.g. by explaining the ecological damage caused by flying.

	Instrument Criteria	Engaging the public	Environ- mental regulations	Instruments using markets			Crea- ting mar- kets
				Sub- si- dies	Char- ges and taxes	Make goods cheaper/ more expensive	
Economic	Costs for individual groups	0%	46%	47%	58%	28%	55%
	Incentives to change behavior	50%	32%	57%	71%	48%	65%
	Weighing of costs and benefits	0%	4%	17%	13%	8%	5%
	Overall economic situation	0%	7%	13%	8%	20%	5%
	Incentives for technological progress	4%	7%	20%	29%	12%	30%
Ecological	Ecological improvement/deterioration	11%	14%	0%	4%	4%	45%
	Ecological attainment	0%	0%	0%	0%	0%	10%
Social	Justice	0%	0%	13%	4%	16%	10%
Other	Feasibility	7%	25%	7%	17%	12%	15%
	Individual freedom	7%	39%	3%	8%	8%	5%
	Ethical justification	4%	4%	7%	13%	0%	15%
	Control options	11%	4%	0%	0%	0%	0%
	Practical reservations	4%	18%	7%	4%	0%	0%
Number of group discussions, in which a certain instrument has been considered		28%	28%	30%	24%	25%	20%

There was a total of 32 group discussions, i.e. 16 groups and each of them discussed two scenarios. Teacher trainees were not forced to address all instruments in every discussion. Therefore, the last line of the table indicates the number of group discussions, in which teacher trainees have considered a certain instrument. Percentage values are created by dividing the number of group discussions a criteria is used through the number of discussions, in which an instrument was named.

Environmental regulations have been mostly evaluated by their costs to individual groups (46%), incentives to change behaviour (32%), limitations to individual freedom (39%) and feasibility (25%). While Economics is also sceptical about environmental regulations, an

important distinction compared to a disciplinary perspective lies in teacher trainees' focus on absolute costs, while the emphasis in Economics is the comparison of costs to the incentives created.

Instruments using markets have been mainly assessed based on their capacity to change behaviour and their costs to consumers (see table 4). Interestingly, more teacher trainees believe that subsidies can change behaviour than taxes. This is often linked with teacher trainees arguing that they themselves would consume differently, if ecological options were more affordable. In contrast, they tend to argue that increasing prices would not work, because the demand for a certain good is "too strong" or, expressed scientifically, inelastic. In contrast, there is no clear consensus in Environmental and Ecological Economics whether subsidies or taxes are more effective and theoretically, both should work the same way.

Instruments creating markets refer almost always to emission-trading schemes. Teacher trainees more frequently (45% of the discussions) consider ecological improvements/deterioration here than with other instruments. About half of the statements argue that emission allowances lead to an ecological improvement, the other half argues that they would only cause a shift from one emitter to another, but not lead to an absolute reduction. Similarly about half of the statements argue that emission allowances can change behaviour; the other half is not convinced.

Comparing instruments, it is noteworthy that economic criteria occur more often with market based (using and creating markets) instruments. This could be due to the fact that changing financial incentives is part of these instruments themselves, whereas connections to economic costs are less straightforward with the other instruments. The social criterion of justice is only mentioned in relation to market-based instruments. This is quite reasonable as students focus on the possible exclusion of individual groups: While instruments regulating the environment and engaging the public, at least in theory, target all people or companies regulated equally, price adjustment might lead to the exclusion of individual groups.

SUGGESTIONS FOR TEACHER TRAINING

The analysis of value criteria used by the teacher trainees has shown that they usually do not think in means-end-relations typical for Economics. In the economic dimension, their focus is mostly either on the economic costs for individual groups or its incentives for a behavioural change. Teaching here should aim for a "fusion" (Marton, 2015) of both partial concepts. Applying variation theory (Marton, 2004; Marton & Pang, 2013; Pang, 2010; Pang, Linder & Fraser, 2006; Pang & Marton, 2003), I suggest the following learning path. First, like in Environmental Economics textbooks, costs of a market-based instrument (e.g. a tax) and an instrument regulating the environment (e.g. a limit on emissions per unit of output) could be compared by looking at an economy with two companies, which have different marginal abatement costs. Secondly, changes regarding the incentive structures are compared when varying tax rates or the emission limit. Thirdly, the cost and the incentive aspect are brought together by a joint variation, e.g. by letting teacher trainees argue what would change, if abatement technology became cheaper, but new scientific evidence would indicate that higher emission reductions are necessary.

In the ecological dimension, teacher trainees assessed whether instruments are capable to improve or deteriorate environmental conditions, but this has not been connected to a specific objective. Teaching here could involve a modified version of the fish banks game (Meadows, Sterman, & King, 2014) where, in a first round, students are allowed to set up rules once, so that

they can see the advantages of a specific ecological goal in contrast to an unregulated condition. In a second round, continuous negotiations are allowed for students to be able to identify a sustainable fishing scale. The reflection of the game should focus on the differences between the two rounds.

Teacher trainees' conceptions of justice focused on the consequences for individual groups and not on the income distribution in general. Teaching should involve reflecting differences, particularly in relation to policy proposals.

For teacher trainees to apply the criteria or to develop their own ones, the case method (Carlson & Velenchik, 2006) can be used. The basic structure of the cases can be similar to the scenarios presented in the appendix, however data comparing costs and benefits of the instruments should be provided. Learners are then asked to define policy goals and an appropriate policy mix to reach them.

To critically reflect economic approaches towards the environment and to compare them with others, a debate (Salim, 2015) might complement the teaching process. Here, different measures to regulate an externality can be discussed, e.g. representatives of a commercial association favouring voluntary commitments, of an environmental association pledging for an obligation and of a company using environmentally-friendly technologies calling for market based instruments. The aim would be to convince the audience from the respective position.

These suggestions for a curriculum have been designed for university education with teacher trainees in Economics. If applied to undergraduate, and particularly graduate education in Economics in general, it might be worthwhile to consider spending more time on comparing costs and benefits of individual instruments, especially by looking theoretically and empirically comparing the different market-based instruments.

CONCLUSION

Studying Economic Policy Instruments for the Environment (EPIs) is not only beneficial for teachers in economics and citizens in general as EPIs are widely used in Environmental and Ecological Economics as well as environmental policy, but also because one can learn about economic reasoning in general when understanding EPIs. The economic approach embedded in EPIs has a focus on reaching goals cost-effectively and analyses how incentives are set. Furthermore, by evaluating EPIs, one can spot differences between Environmental and Ecological Economics.

Empirically, I have analysed how teacher trainees in economics handle problems which can be addressed using EPIs and typical value criteria in Environmental and Ecological Economics (efficiency, sustainable scale, distribution). The main results were that teacher trainees have difficulties to jointly look at the incentives set by an instrument and the costs it involves for different groups. Furthermore, the teacher trainees have hardly looked at means-end-relations. Usually, they just evaluated whether an instrument might have the potential to improve an ecological problem, but they did not consider which goal could be reached at what price with an instrument. Based on teacher trainees' preconceptions and core contents from the discipline, I proposed a short curriculum on EPIs which takes the preconceptions of the teacher trainees as a starting point and then aims to develop these understandings towards an approach which is typical for Environmental and Ecological Economics.

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APPENDIX

Scenarios Type I		
ECONOMIC POLICY INSTRUMENTS AND THEIR EVALUATION		
Thema/ Topic	Stimuli	Stimuli
Emissionen/ Emissions	Wie Ihr vermutlich wisst, wird der Klimawandel durch den Ausstoß von Treibhausgasen gefördert. Mich würde nun interessieren, was Ihr so für Ideen habt oder kennt, was man tun könnte, um den Ausstoß von Treibhausgasen zu reduzieren und was Ihr von den Ideen haltet bzw. wie Ihr sie beurteilt?	As you probably know, the emission of greenhouse gases contributes to climate change. So, I would be curious to know what ideas you have, what one could do, to reduce greenhouse gas emissions and what you think about the ideas or how you judge them?
Solarfarbe/ Solar paint	Wie Ihr vielleicht mitbekommen habt, haben Forscher eine Spezialfarbe entwickelt. Wenn man diese an Außenwände streicht, kann damit Sonnenlicht in Energie umgewandelt werden. Mich würde interessieren, was Ihr so für Ideen habt, was man tun könnte, damit diese Farbe genutzt wird und was Ihr von den Ideen haltet bzw. wie Ihr sie beurteilt?	As you might have heard, scientists have developed a special paint. When one applies it to outdoor walls, it can transform sunlight into energy. So, I would be curious to know what ideas you have, what one could do so that this paint gets used and what you think about the ideas or how you judge them?
Emissionen im Flugverkehr/ Emissions in air traffic	Wie Ihr vermutlich wisst, entstehen beim Fliegen umweltschädliche Emissionen. Mich würde interessieren, was Ihr so für Möglichkeiten seht bzw. was man tun könnte, damit weniger umweltschädliche Emissionen durch das Fliegen entstehen und was Ihr von den Ideen haltet bzw. wie Ihr sie beurteilt?	As you probably know, environmentally harmful emissions arise out of air traffic. So, I would be curious to know what ideas you have, what one could do to reduce environmentally harmful emissions through air traffic and what you think about the ideas or how you judge them.
Ökolebensmittel/ Organic food	Wie Ihr vielleicht wisst, ist der Anteil von ökologisch produzierten Lebensmitteln an den insgesamt produzierten Lebensmitteln recht gering. Mich würde interessieren, was Ihr so für Ideen habt, was man tun könnte, damit mehr ökologisch produzierte Lebensmittel hergestellt werden und was Ihr von den Ideen haltet bzw. wie Ihr sie beurteilt?	As you might know, the share of organic food in total food production is pretty low. So, I would be curious to know what ideas you have, what one could do so that more organic food is produced and what you think about the ideas or how you judge them?

Scenarios Type II		
COMPARING AND EVALUATING ECONOMIC INSTRUMENTS		
Thema/ Topic	Stimuli	Stimuli
Solar- farbe/ Solar paint	<p>Wie Ihr vielleicht mitbekommen habt, haben Forscher eine neue Spezialfarbe entwickelt, die Sonnenlicht in Energie umwandeln kann. Was haltet Ihr von folgenden Maßnahmen, um diese Technologie zu fördern? Wenn Ihr Ideen habt, wie man diese Maßnahmen besser gestalten könnte, könnt Ihr diese natürlich auch äußern.</p> <ol style="list-style-type: none"> 1. Durch eine Informationskampagne wird die Bevölkerung über die Vorteile der neuen Farbe informiert. 2. Ab Anfang 2015 darf nur noch die Spezialfarbe verkauft werden. Alle anderen Außenfarben werden verboten. 3. Jeder Hausbesitzer, der die Spezialfarbe benutzt, bekommt für fünf Jahre eine Steuererleichterung. 4. Die Farbproduzenten bekommen in den nächsten fünf Jahren eine Prämie für jeden verkauften Liter der neuen Spezialfarbe. 5. Die Farbindustrie wird verpflichtet Schadstoffzertifikate zu kaufen: Für jeden Liter Farbe, der Schadstoffe enthält, muss sie ein solches Zertifikat nachweisen. Für schadstofffreie oder energieleitende Farbe müssen keine Zertifikate erworben werden. Die Zahl der zur Verfügung stehenden Zertifikate wird jedes Jahr reduziert. 	<p>As you might have heard, scientists have developed a special paint, which can transform sunlight into energy. What do you think of the following measures to promote this technology? In case, you have ideas on how to improve these measures, you are of course welcome to express them as well.</p> <ol style="list-style-type: none"> 1. Through an information campaign, the population is informed about the advantages of the new paint. 2. Starting at the beginning of 2015 only the special paint may be sold. All other outdoor paints will be prohibited. 3. Each landlord, who uses the special paint, will be granted a tax relief for five years. 4. Each paint producer will receive a premium for every liter of special paint sold within the next five years. 5. The paint industry will be obliged to buy tradable emission permits: For every liter of paint, which contains pollutants, they will have to present such a permit. For unpolluted or energy conducting paint, no permits have to be bought. The number of available permits will be reduced every year.
Flug- verkehr/ Air traffic	<p>Wie Ihr vermutlich wisst, entstehen im Flugverkehr umweltschädliche Emissionen. Was haltet Ihr von folgenden Maßnahmen, um die Emissionen im Flugverkehr zu begrenzen? Wenn Ihr andere Ideen habt oder Vorschläge, wie man diese Maßnahmen besser gestalten könnte, könnt Ihr diese natürlich auch äußern.</p> <ol style="list-style-type: none"> 1. Durch eine Informationskampagne wird die Bevölkerung über die Klimaschädlichkeit des Fliegens und über ökologischere Alternativen informiert. 2. Flüge werden auf Strecken verboten, auf denen die Bahn weniger als sechs Stunden benötigt. 3. Die Flughafengebühr, die jede_r Reisende entrichten muss, wird erhöht. 4. Die Besteuerung von Flugbenzin bzw. Kerosin wird angehoben. 5. Alle Fluglinien werden verpflichtet, CO₂-Zertifikate zu kaufen: Für jede Tonne CO₂, die sie ausstoßen, müssen sie ein solches Zertifikat kaufen. Die Zahl der zur Verfügung stehenden Zertifikate wird jedes Jahr reduziert. 	<p>As you probably know environmentally harmful emissions arise out of aviation. What do you think of the following measures to limit emissions in aviation? In case, you have ideas on how to improve these measures, you are of course welcome to express them as well.</p> <ol style="list-style-type: none"> 1. Through an information campaign, the population is informed about the negative consequences to climate change due to aviation and about more ecological alternatives. 2. Flying will be prohibited on routes on which railways need less than six hours. 3. The airport tax, which every traveler has to pay, will be increased. 4. The taxes on jet fuel or kerosene will be increased. 5. The airline companies will be obliged to buy CO₂ tradable emission permits: For every ton of CO₂, which they emit, they will have to buy such a permit. The number of available permits will be reduced every year.

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