



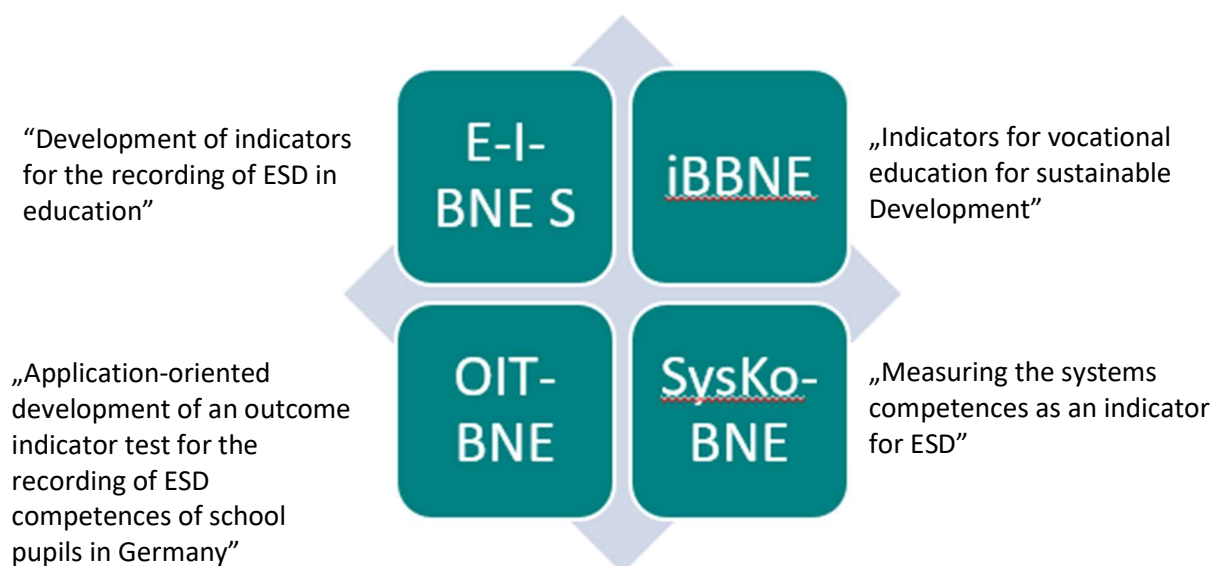
Developing ‘Education for Sustainable Development’- Indicators for educational reporting in Germany

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The German Contribution to the Monitoring of Education for Sustainable Development

The German Federal Ministry of Education and Research funds the development of ESD-indicators in Germany. Therefore, four joint research projects are to develop indicators for ESD (4.7.1) in the area of schools and vocational schools. The indicators shall be used for the German National Sustainability Development Strategy and (sub-)national, educational reporting. The project funding lasts from January 2019 to December 2021.

13 Partners in four joint research projects:



Project Description SysKo-BNE: „Measuring the systems competences as an indicator for ESD“

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The project “SysKo-BNE” aims at developing a test instrument the outcomes of which could be used as an indicator for Education for Sustainable Development (ESD). Within the framework of ESD, system competence is considered to be a key factor, as in view of the high degree of factual complexity of the challenges of the 21st century, it is considered to be the basis for making decisions in terms of sustainable development (Rost, 2005; Rieckmann, 2017).

System competence is defined as the ability to understand areas of complex, socio-ecological reality as systems on a local and global level and, on this basis, to make prognoses and take measures for system use and regulation (Mehren, Rempfler, Ulrich-Riedhammer, Buchholz & Hartig, 2016). Socio-ecological areas of reality that are central within the education for sustainable development (ESD) as reflected in numerous publications are (1) climate and climate change, (2) natural resources (especially water and soil), (3) urbanisation and settlement development, (4) production, consumption and (alternative) energy(s), (5) poverty and justice and (6) migration (see for example Rieckmann, 2017; European Commission, 2015). Among others, different aspects of multi-perspectivity play a central role for system competence in the field of ESD: (a) Considering social, ecological, economic and political or cultural dimensions, (b) systematically switching between local and global approaches and (c) taking into account the temporal perspective of intergenerational justice.

The first step was the item development. Firstly, question stems that focus on crucial themes of ESD were developed. The specific content of the tasks deals with (1) electronic waste, (2) climate change and coral dying, (3) megacities, (4) meat consumption and the rainforest, (5) textile production and (6) overtourism. Secondly, we developed items targeting different levels of socio-ecological system understanding (on the basis of an empirically confirmed competence level model) within each of the testlets. Expert judgements were included for the question stems as well as for the items in order to validate both content-related and conceptual requirements.



The developed items were then tested in a cognitive laboratory (Prüfer & Rexroth, 2000). In a cognitive walk-through, the task developers first specified the processes and steps that are likely to be necessary for a task solution. The students were then encouraged to think aloud while working on the items. This provided insights into the understanding of the items, into solution strategies and particular difficulties and helped us adapting the items accordingly. We have also had our test items assessed by experts in the field of ESD and system competence as well as by teachers and have incorporated their feedback into our revisions.

We have collected the data for quantitative piloting. Our tasks were presented to a sample of $N = 400$ students (16 classes) of the 8th and 9th grade. The results from the quantitative pilot study suggest that the development of our system competence test was successful in terms of yielding a high reliability, a good match of the distributions of item difficulties and the levels of students' competence. Furthermore, only a small proportion of items had to be sorted out due to a lack of fit with the (partial credit) Rasch model and, related to this, due to a lack of capacity to distinguish high and low competent persons. First analyses of dimensionality suggest that the test measures a one-dimensional construct, namely system competence.

We are currently recruiting schools for participation in our calibration study ($N = 1000$ students; 40 classes) that should allow in-depth analyses of dimensionality, the definition of competence levels and the comparison of alternative scoring methods.

Once these development steps have been completed, we would like to present a compact, easy to interpret and yet reliable and valid instrument to measure system competence in the field of ESD that can be used across different school subjects. These characteristics of the indicator enable it to be included into international educational monitoring reports, and particularly, it can serve as an outcome indicator for SDG 4.7. However, it is also suitable for evaluating ESD measures.

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Project Description E-I-BNEs: “Development of indicators for the recording of ESD in education”

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Education for Sustainable Development (ESD) as an important societal concern is to be increasingly integrated into the structures of schools and teaching. This corresponds to the goals of the Global Action Program and the 2030 Agenda. It contributes to the achievement of SDG 4 Quality Education. The project’s aim is to develop indicators for an assessment of ESD in the field of general education schools, for the indicator areas of input and output. Their purpose is to measure progress in the structural implementation of ESD.

Input-Process-Outcome-Model: Based on theory, school education is subdivided into six topics/indicator areas (resources, framework conditions, curriculum, first phase of teacher training, second phase of teacher training, school as learning location). An indicator for continuing education was already available before the beginning of the project.

The scientific approach is similar within the six areas: (1) suggestion of indicators (based on existing suggestions, evaluation of the relevance as a national indicator, additions and modifications if applicable), (2) exploratory discussions with experts, (3) development of a justified indicator set, (4) data collection, first application testing, (5) first phase of consultation (expert workshop, school expert forum, universities), (6) if applicable modifications and development of a justified, revised indicator set, (7) second phase of consultation (online consultation with further experts and professionals), (8) if applicable final modification, final indicator set, application. A publication of the results follows. In addition, the network of partners participates in the suggestion of a pars-pro-toto indicator and a comprehensive indicator.

Literature, expert interviews and consultations lead to the main areas key figures for the indicators can be gathered from: interdisciplinary goals within curricula, continuing education, school labels, teacher training standards of the Standing Conference of the Ministers of Education and Cultural Affairs, ESD strategies of the Länder. Besides, promoting and inhibiting factors influencing the implementation in the school system become clear. Federalism of the German education system and the various types of schools complicate the access to data and make the data collection and processing very complex.

Project Description OIT- BNE: „Application-oriented development of an outcome indicator test for the recording of ESD competences of school pupils in Germany“

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The Federal Ministry of Education and Research of Germany (BMBF) funds the development of a set of indicators to assess pupils' competence development in the field of Education for Sustainable Development (ESD). In this context, the Otto-von-Guericke University Magdeburg, the University of Education Ludwigsburg and Ackerdemia e. V. - Association for Applied ESD are engaged within the joint research project „Application-oriented development of an outcome indicator test for the assessment and operationalization of ESD competences of pupils in Germany (OIT-BNE)“.

The development of the ESD outcome indicator test is based on a comprehensive assessment of the thematic fields as well as the fields of action of ESD. The assessment considers empirical and theoretical, national and international preliminary research on ESD in general as well as the practice of ESD in schools in particular. Conceptually, the test is based on an established competence model (Otto, et al., 2020; Roczen, Kaiser, Bogner, & Wilson, 2014), consisting of three components (knowledge, motivation and action), it integrates ESD thematic fields relevant for the age group and it is applicable consistently from primary- to high school-level.

The aim of OIT-BNE is to ensure the practical relevance and applicability of the measuring instruments as well as their sufficient sensitivity to assess transformation processes from childhood to adolescence. The test is empirically validated with students aged 8 to 19 years in an iterative development. The test is provided digitally and optimized for smartphones fostering IRT-based computerized adaptive testing (CAT), i.e. the test adapts to the examinee's ability level. The OIT-BNE-indicator set is intended to be included into the sustainability monitoring of the German Federal Government and therefore compatibility with the Sustainable Development Goals (SDGs) of the United Nations (UN) and other reporting formats is key. The findings will be published and communicated.

Work status

In order to develop a valid set of indicators, the state of research was recorded through a systematic literature review. Out of N = 9374 ESD articles, n = 1319 articles were selected as relevant for our ESD

issues and scientifically adequate. ESD definitions were categorized and related to the discussed SDGs, the quality of the ESD definitions and the world region origin of the publications. Additionally, we conducted a comprehensive overview of existing ESD-related assessment tools, providing us with information concerning the current efforts to measure relevant outcomes as a basis for our own development.

This was followed by a series of expert interviews. This qualitative evaluation revealed the main focal points of the discussion. The findings together with the systematic literature review and the measurement analysis made it possible to assign the SDG sub-goals to six overarching, age-group-relevant fields of action of (1) consumption & mobility, (2) climate protection, (3) health, (4) social affairs & involvement, (5) participation & engagement and (6) economy. In the questionnaire development, these six fields of action were defined as basis for the cross-sectional survey in secondary-school level. Another aim, however, is to use quasi-longitudinal conclusions from the field of consumption & mobility about ESD development. Therefore comic-based vignettes are used to ensure that the test is suitable from primary to the end of secondary level as an outcome indicator independently from literacy level.

Results of the first pilot test show a too strong correlation between the language level in the formulation of the items and the item difficulties. In order to eliminate this bias, significant linguistic simplification were provided, measured with the reading index (LIX). A second pilot test is currently being evaluated. Its results will be used to optimize the IRT-based computerized adaptive testing (CAT).

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Project Description {iBBnE}: „Indicators for vocational education for sustainable Development“

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The national project "Indicators Vocational Education for Sustainable Development" {iBBnE}, funded by the German Federal Ministry of Education and Research (BMBF), is concerned with the development of indicators for the SDG subgoal 4.7 "Education for sustainable development and global citizenship" over the project period (1 January 2019 to 31 December 2021). The focus is on the dual system with the two learning locations vocational school and company. Against this background, the research team, consisting of the Research Institute for Vocational Education and Training (f-bb) (coordinator), the Federal Institute for Vocational Education and Training (BIBB), the Center for Sustainable Governance (FHM/CSG) and the University of Hamburg/Institute for Vocational and Business Education (IBW), is pursuing the goal of identifying appropriate indicators that can systematically and continuously record and map the implementation, development and implementation problems of sustainable development in vocational education and training (BBNE).

The indicators should be designed in such a way that they can be integrated into national reporting and made measurable for the requirements of the German Sustainability Strategy. In addition, the indicators developed will be used to check whether the objectives of the National Action Plan for Education for Sustainable Development (ESD) have been achieved and to ensure that it is compatible with international standards.

Document and secondary data analyses as well as explorative expert interviews and workshops will be used to identify potential indicators. In a multi-stage research process, the indicators will be evaluated by vocational training experts regarding to their suitability and connectivity, and their ascertainability within an existing survey. In order to identify a specific set of indicators for ESD, a "search field matrix" (model) with a total of 11 indicator areas on three different levels (micro, meso and macro levels) was first set up. In the further research process, four areas were prioritized: "normative requirements", "examinations", "eligibility of vocational training personnel" and "

occupational professionalism". Suitable indicators are currently being developed for these areas.

The greatest challenge here is to determine the most meaningful indicators possible, which can be collected with a minimum of time and personnel effort. In particular, translating the qualitative educational claim of the idea of sustainability into indicators turns out to be the mayor obstacle. After further explorations, a set of indicators and a particularly relevant pars pro toto indicator for the vocational training system will be presented and checked for feasibility at the end of the project.