

COMPETENCIES OF ESD MULTIPLIERS: WHAT KNOWLEDGE DO TEACHERS AND NON-SCHOOL ACTORS HAVE? RESULTS FROM AN EMPIRICAL RESEARCH

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Abstract

In the world action program, the training of ESD multipliers in a field of action is clearly named as a goal, because competent actors are required to integrate ESD into the educational landscape. So far, however, little is known about the ESD-specific professional competence of geography teachers and extracurricular workers. This article deals with the specific knowledge that ESD actors need to have in order to do competent teaching. Professional competence is made up of both knowledge and non-cognitive aspects, teachers and non-scholar ESD-actors need this esd-specific action competence. There is a lack of empirical evidence, which is necessary to be able to map the competence of ESD groups of actors. In this study, a survey instrument was developed which measures ESD-specific competence with a standardized questionnaire. The differences in professional competence were measured using the example topic "climate change". The sample included both geography teachers and non-formal actors from environmental centers and educational institutions for global learning in northern Germany. It is a hypothesis-based study. Contrary to the assumptions, the non-formal actors achieved better values and thus have more ESD-specific competence. It is necessary to integrate ESD in all phases of teacher training and to develop it consistently. The article presents the difference in professional competence between geography teachers and non-formal workers and provides an outlook on possible causes and

consequences for the future training of ESD actors.

Key words: ESD in Germany, professional action competence, ESD competence, multipliers, training.

Introduction

With the adoption of the so-called Agenda 21, the United Nations (UN) Conference in Rio de Janeiro in 1992 marked the start of the model of sustainable development. Since then, Education for Sustainable Development (ESD) should be a present component in the educational landscape and in the everyday teaching and learning process. The UN Decade for ESD from 2005 to 2014 (UNESCO 2015) and the subsequent World Action Program (WAP) (UNESCO 2015-2019; extended 2020-2030) aim to implement ESD in all areas of education. One of its goals is to enable all citizens to help shape sustainable development. A transformation of society is necessary and cannot take place without education. Education for Sustainable Development (ESD) can play a key role here and turn the multipliers into change agents.

This is an important educational task to which all school subjects, but also formal and non-formal institutions beyond the school, are obliged. Alongside ESD in schools, non-formal education is an indispensable component on the way to a more sustainable society. Little is known about the knowledge and skills of the multipliers at both national and international level. One challenge is the high diversity within the pool of ESD actors, as they are active in all areas of education from early childhood education to university, both in and outside of school. The article is based on a study (Reinke 2017, Reinke & Hemmer 2017) and focuses on school and extracurricular education. It would like to empirically determine how extensive the knowledge and skills of ESD actors are in these two areas and whether and how they differ (e.g. Reinke & Hemmer 2017).

This requires a measurement of the professional competence of these two groups of actors. This was ascertained with a quantitative study, which is briefly presented in this article. After a short presentation of the theoretical basics and the methodology,

the central results for the cognitive facets of specialist knowledge, subject-didactic knowledge and pedagogical knowledge as well as the non-cognitive components of professional action competence for motivation and self-efficacy are shown. These results are discussed below using the hypotheses that led the study. A brief outlook with consequences for practice rounds off the article.

Theoretical background

There were two main pillars for this study. On the one hand, it required an intensive examination of the developments and concepts of sustainable development and education for sustainable development. On the other hand, it was essential to examine research on the professionalism of teachers and, in general, on professional research. There has so far been hardly any research in the field of non-formal education, especially on the last aspect.

Let us first turn to the first pillar, which relates to sustainable development and ESD. In both areas there is a multitude of research on different topics. Even when concretizing the terms and defining sustainable development and ESD, you will find a large number of works and conceptualizations.

Only a few brief definitions should be mentioned here. According to Dobson (1996), more than 300 interpretations of terms can be found (cf. Bagoly-Simó 2013, 5).

However, a clear conceptualization often begins to become difficult with the clear use of the terms, whereby a challenge in the context of this work is evident: Both the conscious use of the terms sustainability and Sustainable Development (SD) as well as the multitude of different uses show the diverse occupation at international level with the topic, but also contribute to a certain confusion, which in turn makes the clear conceptualization of ESD more difficult. Sustainability and sustainable development are sometimes used synonymously. But the concept of development is also so diverse. However, according to Tremmel, there is a discourse about the terms and concepts sustainability and SD predominantly only in the German-speaking area (Tremmel 2004, 27).

Based on these thoughts it can be stated: There is no generally valid and only correct conceptualization or definition of the terms. For your own work, however, your own definition should serve as a working basis. According to SD the work of Jörg Tremmel (2004) forms the essential basis for the present work, as Tremmel examined the relevant models and conceptualizations and developed the analytical model of sustainability on the basis of these studies. As the “result of the analytical definition” (Tremmel 2004, 31) these three dimensions - ecology, finance, social - emerge, which Tremmel also calls fields of activity. Tremmel also includes both intergenerational and intragenerational justice.

With the perspective of ESD, Tremmel's model can be combined very well with the so-called “Gestaltungskompetenz” of de Haan (2008), which is suitable for school and extracurricular education. „Gestaltungskompetenz“ (de Haan 2008) means the ability to apply knowledge about sustainable development and to recognize problems of unsustainable development ”(de Haan et al. 2008, 187). This definition makes clear that both knowledge and action are decisive in the development of „Gestaltungskompetenz“. For application and action, however, knowledge is first required.

Some conceptualizations of the competence already exist for the multipliers. One example is the concept “Competencies for Education for Sustainable Development (KOM-BiNE, Rauch, Steiner & Streissler, 2008), it focuses strongly on working together in a team and focuses on non-cognitive aspects.

Another model that is funded by the EU / Erasmus + is “A rounder Sense of Purpose” (RSP), which continues the work of UNECE and UNESCO (e.g. Scherak & Rieckmann, 2020). This model contains twelve overarching competencies that are assigned to the categories “holistic thinking”, “visions for change” and “achieving transformation”.

In the context of the study described here, however, a central focus was placed on ESD-specific knowledge and a model for measuring knowledge was developed, for which the second theoretical pillar was necessary. As mentioned at the beginning, there is quite a lot of research in the area of teacher professionalism.

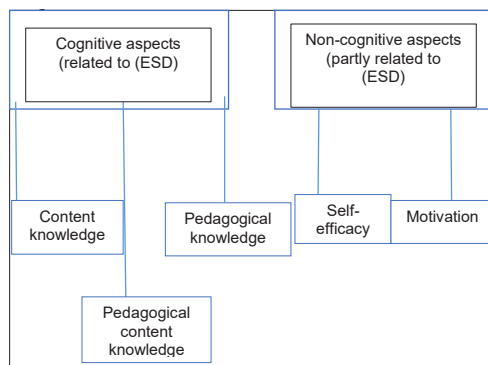
In this context, it should also be mentioned that the research here has to be differentiated into didactic and pedagogical professionalism and that there is a much wider range of studies for the last field (e.g. Witt, 2009; Paseka, Schratz, & Schritteser, 2011; Helsper, 2011) as on subject-specific professional knowledge in subject didactics (e.g. Kunter et al., 2011; Krauss et al., 2017; Weschenfelder, 2014) and also in geography (e.g. Hemmer, Hoffmann & Mehren, 2020; Engelhardt, 2020; Lindau, 2020). In the domain of ESD, which is difficult to define, two studies have already started to deal with professional knowledge (Hellberg-Rode, Schrüfer & Hemmer, 2014; Hellberg-Rode & Schrüfer, 2016).

Knowledge is an integral part of competence. According to Kunter et al. (2011) it can be differentiated into professional declarative and procedural knowledge, but according to Terhart (2001) routines and reflection are also part of it. Some aspects of this can also be found in the structural theory debate, but less focused on school practice.

In addition to the work mentioned above, this article should also focus on the clearly defined dimensions of knowledge in the teaching profession. In this context, the concept of Lee Shulmann (1986) has largely prevailed. This initially established the following differentiation: general pedagogical knowledge, content knowledge and pedagogical content knowledge as well as knowledge of the specialist curriculum.

In the present study the availability of knowledge on ESD was essentially the focus of knowledge, the COACTIV model (Kunter et al. 2011, Shulman 1986) is a good basis for measuring the professional competence of ESD actors. On this basis, a model for the professional competence of ESD actors has been developed for this study.

Figure 1: Model for the professional competence of ESD actors. Own design based on Kunter et al. 2011.



Based on this model and with the theoretical background, the hypotheses and the central question were developed:

What is the composition of professional competence in ESD actors and what are the differences between geography teachers and non-formal actors?

The facets of the model have been further differentiated. Hypotheses were developed for each facet. The hypotheses on the cognitive aspects expressed that the teachers have more knowledge because they have acquired this, for example, during their studies and they teach. Relatively similar results were expected with regard to the non-formal facets, but more motivation for ESD among the non-formal actors. Geography is an important subject for ESD and studies are already available for implementation in curricula (e.g. Bagoly-Simó 2014 & 2018, Bagoly-Simó & Hemmer 2017).

Research Methodology

At this point the methodology of the study is briefly described. The research project is based on a quantitative-empirical design and is hypothesis-oriented. The sample included 50 geography teachers from German high schools (Lower Saxony) for the formal education sector, since geography is an important subject for ESD. Another 52 non-formal actors from environmental centers or centers for global learning were included in the sample. With regard to the age of the

test persons, the entire sample was very heterogeneous, including young professionals, but also retired people who were still active in an environmental center on a fee basis. Both groups were asked about their previous knowledge of ESD.

A standardized questionnaire was designed as a survey instrument, which contains both open and closed items and depicts the sub-facets designed in the model (see Fig. 1). The items were operationalized on a theoretical basis for the individual facets of professional action competence. The conceptual knowledge was deliberately outsourced as a separate area, as the study by Hellberg-Rode, Schrüfer and Hemmer (2014) showed that knowledge of the concept of sustainable development is seen as essential. The items for the cognitive facets include so-called anchor situations: Fictitious situations from educational offers/lessons are briefly described, followed by items that relate to this situation. The topic of climate change was chosen as an example of the content of the cognitive facets in the technical and didactic aspects, as it is suitable on the one hand because of its clear cause-and-consequence-measure structure and on the other hand is a topic of educational offers in both formal and non-formal education. The survey was carried out using the paper-pencil method in the presence of the author.

Results

At this point only the main results of the facets are briefly summarized. First, let's refer to the cognitive facets.

Content knowledge, general knowledge of an adult about climate change: The results do not show any major differences; the non-formal actors only achieve slightly higher values.

Content knowledge, Conceptual knowledge about sustainable development and ESD: The non-formal actors achieve significantly higher scores in this facet.

Pedagogical content knowledge: The non-formal actors also scored better than the teachers.

Pedagogical knowledge: The non-formal actors also scored better than the teachers.

There were no major differences in the non-cognitive facets of motivation and self-efficacy.

Motivation for the topic of climate change and ESD: The values of the non-formal actors were slightly higher here, but the difference was not high.

General motivation for educational work: In this subfalte, the teachers achieved better values.

Self-efficacy: No notable differences were found in this facet.

Discussion

Content knowledge

For the cognitive facet of content knowledge, two hypotheses were formulated in advance, which had to be empirically tested. The first hypothesis was:

“The teachers have better ESD-relevant content knowledge on climate change because they have acquired specialist knowledge in the domain during their studies.”

The results of the measurement show that the hypothesis cannot be confirmed, so it should be discussed why the teachers do not have better ESD-relevant specialist knowledge on climate change than the extracurricular actors, who may know just as much despite a lack of training. One possible thesis is that the training of teachers can still be optimized with regard to the complexity of the topic of climate change and that the topic with its areas of phenomena, causes, effects and measures is not yet adequately dealt with in training and further education. In particular, the aspect of “measures to combat climate change” is less likely to be the subject of specialist training. The items related to this and to prognoses did not achieve high values. Reinfried and Künzle (2019) analyze in a study the interpretation patterns of climate change in the statements of teachers and the consequences for climate communication in the classroom. Accordingly, the connections are not immediately fully understood by many, which inhibits acceptance.

“It is thus a hybrid theme essentially founded on uncertainty” (González-Gaudino & Meira-Carda, 2010, 13). With regard to dealing with uncertainties in the example topic, this is an aspect that should not be neglected, for which the teacher training course has not yet been necessarily prepared. There are already studies and exemplary work on ESD at universities (e.g. Bagoly-Simó, Hemmer & Reinke 2017).

Furthermore, the thesis arises that teacher training and informal learning are not optimal with regard to the dynamics of the topic of “climate change”.

The second hypothesis on specialist knowledge focused on conceptual knowledge about ESD: The non-formal workers have more conceptual knowledge about ESD and sustainable development. The conceptual knowledge of ESD and SD is significantly higher among the actors outside of school. This verifies this hypothesis. Non-school actors in ESD deal with the ESD concept from the ground up, as this is an integral part of their job description. In the non-formal educational institutions, ESD is part of the profile or mission statement, so that good knowledge can be assumed. Michelsen, Rode, Wendler and Bittner (2013) deal in their studies with the non-formal educational institutions themselves and certify that they are well on the way to implementing the ESD concept and suggest further steps, Wittlich (2021) also shows in detail the pedagogical value of extracurricular education in ESD.

Pedagogical content knowledge

In this facet, the results show, contrary to the hypothesis, that the non-formal actors achieve higher values and thus have more knowledge than the geography teachers. In order to teach effectively, specialist knowledge and didactic knowledge are required, as there is a direct connection between existing specialist knowledge and didactic competence (e.g. Shulman, 1986 & 1987; Kunter et al., 2011; Kleickmann et al., 2012). With regard to the results, it can now be deduced that the technical knowledge of the teachers about climate change is not optimal and therefore also the didactic knowledge can be optimized, because only teachers who have deepened the content

are able to didactice it and in teaching concepts to convict. However, that does not explain why the non-formal actors do better in this didactic area. This is presumably related to a targeted, in-depth study of the topic and to the fact that nonformal actors do not deal with numerous topics at the same time, as they can offer more focused courses and generate expert knowledge in these areas. Another thesis can be formulated: Increasing professional experience does not always mean more didactic competence. The specific objectives of geography lessons have changed again and again in the past decades (e.g. Reinfried & Haubrich, 2015; Rinschede & Siegmund, 2020), which has also influenced the content of the course, so conclusions can be drawn about the period of study and ESD may not always have been an issue.

Pedagogical knowledge

The pedagogical knowledge hypothesis was also not supported. Contrary to expectations, the non-formal group has significantly more pedagogical knowledge. What reasons could there be for this?

Of the 52 people from the non-formal education sector, 17 have an educational background and some have already worked in other professions in the education sector. Non-formal actors benefit in part from basic educational training. The non-formal multipliers do not orientate themselves so strongly to the curriculum when structuring their teaching. Rather, they are based on the following aspects: interest of the students, reference to the environment, reference to the future, variety of methods, independent learning, global reference, nature conservation, social relevance and skills development.

Non-cognitive aspects: Motivation and self-efficacy

Both groups achieve good values overall here. With the facet "Motivation for sustainable development and the topic of climate change" the hypothesis that the non-formal actors are more motivated was confirmed. The non-formal multipliers are not so dependent on curricula in their teaching and have more time for BNE methods, for example. The high level of conceptual knowledge will also be a reason for the high level of motivation. With regard to the sub-facet "Enthusiasm for educational work in general" there are no major differences between the groups, but here the teachers achieve

slightly higher values; the hypothesis was that the same values were expected. When choosing a degree, they have already decided in advance to work in the education sector, which is probably not always the case with non-formal multipliers. The results in this facet showed no significant difference, both groups have a similarly high level of self-efficacy, which is also high overall in both groups. The hypothesis, however, was that there will be a difference and that the non-formal actors have a higher level of self-efficacy. Looking back on the operationalization of the items on self-efficacy, the concept of collective self-efficacy (cf. Schmitz & Schwarzer 2002) must be discussed. This harmonizes very well with the idea of “design competence” and working in a team. It is conceivable that the items on the scale of self-efficacy were based too much on the individual due to the focus on individual self-efficacy.

Conclusion

In order to come to a brief summary, briefly possible consequences for future training should be suggested at this point.

The topic must also be present and remain present in all phases of teacher training, and the handling of uncertainties in this subject area must also be addressed.

After this measurement, the actors outside of school have more ESD competence. It is important to use this competence, for example through more intensive cooperation and binding involvement in everyday school life.

Teachers still have too little conceptual knowledge. This is why ESD conceptual knowledge must be integrated into every phase of teacher training - from the course onwards, then onwards in the traineeship and later in further training courses while working.

The specialist knowledge on climate change can still be optimized in both groups of test subjects, but especially among the teachers.

There is still a need for further training and research.

The study, which is very briefly described here in this article, can be further differentiated in a few points. There are many other interesting research fields for future ESD research.

Reference

- Bagoly-Simó, P. (2013). Education for Sustainable Development and School Geography. Theoretical Considerations. *Romanian Review of Geographical Education*, 11(1), 4-25. doi:10.23741/RRGE120131
- Bagoly-Simó, P. (2014). Implementation of ESD at the end of the UN Decade. An international comparative study using the example of subject teaching. *Journal for Geography Didactics*, 42(4), 221-256.
- Bagoly-Simó, P. (2018). Education for Sustainable Development and Geographic Education. *Geographical survey*, 70(10), 10-15.
- Bagoly-Simó, P., Hemmer, I. & Reinke, V. (2017). Training ESD Change Agents Through Geography: Designing the Curriculum of a Master's Program with Emphasis on Education for Sustainable Development (ESD). *Journal of Geography in Higher Education*, 42, 174–191. doi:10.1080/03098265.2017.1339265
- Bagoly-Simó, P. & Hemmer, I. (2017). Education for Sustainable Development in Secondary Schools - Goals, Insights into Reality, Perspectives. [Manuscript]. http://edoc.ku-eichstaett.de/25373/1/Bagoly-Simo_Hemmer_2017_online_end.pdf (7.5.21).
- De Haan, G. (2008). Design competence as a competence concept for education for sustainable development. https://www.researchgate.net/publication/226689376_Gestaltungskompetenz_als_Kompetenzkonzept_der_Bildung_fur_nachhaltige_Entwicklung (08.09.20).
- Dobson, A. (1996). Environment Sustain abilities: An Analysis and a Typology. *Environmental Politics*, 5(3), 401-428. doi:10.1080/09644019608414280
- Engelhardt, K. (2020). Competence-oriented geography lessons need professional teachers. In A. Keil, M. Kuckuck & M. Faßbender (Hrsg.), *Shaping ESD structures together. Didactic perspectives and research on education for sustainable development in teacher training* (Education and World Society; Vol. 13) (S. 63-77). Münster & New York: Waxmann.
- Gonzáles-Gaudiano, E. & Meira-Cartea, P. (2010). Climate Change Education and Communication: A Critical Perspective on Obstacles and Resistances. In F. Kagawa & D. Selby (Hrsg.), *Education and Climate Change. Living and Learning in Interesting Times* (S. 13-24). New York & London: Routledge.

- Hellberg-Rode, G. & Schrüfer, G. (2016). What specific professional skills do teachers need to implement Education for Sustainable Development (ESD)? - Results of an exploratory study. *Biology Teaching and Learning - Journal for Didactics of Biology*, 20(1), 1-29. doi:10.4119/zdb-1633
- Hellberg-Rode, G., Schrüfer, G. & Hemmer, M. (2014). Do teachers need specific professional skills to implement Education for Sustainable Development (ESD)? Theoretical foundations, research design and first results. *Journal for Geography Didactics*, 42(4), 257-281.
- Helsper, W. (2011). Teacher professionalism – The structural theoretical professional approach to the teaching profession. In E. Terhardt, H. Bennewitz & M. Rothland (eds.), *Handbook of research on the teaching profession* (S. 155-170). Münster u.a.: Waxmann.
- Hemmer, M., Hoffmann, K.W. & Mehren, M. (2020). Teaching professionalism and teaching professionalization in the subject of geography - approach from a geographical didactic and practical school perspective. In M. Hemmer, A.-K. Lindau, C. Peter, M. Rawohl & G. Schrüfer (Eds.), *Teacher professionalization and teacher training in geography in the focus of theory, empiricism and practice* (Selected conference contributions to the HGD Symposium 2018 in Münster, Vol. 72) (p. 1-33). Münster: Münsterscher Verlag for Science.
- Kleickmann, T., Richter, D., Kunter, M., Elsner, J., Bessner, M., Krauss, S. & Baumert, J. (2012). Teachers' Content Knowledge and Pedagogical Content Knowledge: The Role of Structural Differences in Teacher Education. *Journal of Teacher Education*, 64(1), 90-106.
- Krauss, S., Lindl, A., Schlicher, A., Fricke, M., Göhring, A., Hofmann, B., Kirchhoff, P. & Mulder, R.H. (Hrsg.). (2017). *FALKO. Subject-specific teaching skills. Conception of professional knowledge tests in the subjects German, English, Latin, physics, music, Protestant religion and education*. Münster & New York: Waxmann.
- Kunter, M., Baumert, J., Blum, W., Klusmann, U., Krauss, S. & Neubrand, M. (Hrsg.). (2011). *Professional skills of teachers. Results of the research program COACTIV*. Münster u.a.: Waxmann.
- Lindau, A.-K. (2020). Subjective perceptions of aspects of professional competence on geographical excursions among teacher training

- students - two case analyzes in the context of group discussions. In M. Hemmer, A.-K. Lindau, C. Peter, M. Rawohl & G. Schrüfer (Eds.), *Teacher professionalism and teacher training in the subject of geography in the focus of theory, empiricism and practice. Selected conference contributions to the HGD Symposium 2018 in Münster (Geography-Didactic Research; Vol. 72)* (pp. 123-148). Münster: Münsterscher Verlag for Science.
- Michelsen, G., Rode, H., Wendler, M. & Bittner, A. (2013). *Extra-curricular education for sustainable development. Methods, practice, perspectives (DBU environmental communication; Vol. 1)*. Munich: Oekom.
- Paseka, A., Schratz, M. & Schritteser, I. (2011). Professional theoretical foundations and thematic approach. In M. Schratz, A. Paseka & I. Stepper (Eds.), *Pedagogical Professionalism: Think outside the box - rethink - new thinking. Impulses for next practice in the teaching profession* (pp. 8-45). Vienna: Facultas publishing house.
- Rauch, F., Steiner, R. & Streissler, A. (2008). *Skills for Education for Sustainable Development (KOM-BiNE). Concepts and suggestions for practice*. Vienna: Federal Ministry for Education, Art and Culture.
- Reinfried, S. & Haubrich, H. (Hrsg.). (2015). *Learning to teach geography. The Didactics of Geography*. Berlin: Cornelsen Scriptor.
- Reinfried, S. & Künzle, R. (2019). Interpretation patterns of climate change in statements by teachers and consequences for climate communication in the classroom. *Journal for Geography Didactics*, 47(2), 45-59. doi:10.18452/20858
- Reinke, V. & Hemmer, I. (2017). Education for Sustainable Development - What competencies do teachers and actors from extracurricular institutions have? *Journal of the Center for Teacher Training and Educational Research (ZLB.KU)*, 1, 38-43.
- Rinschede, G. & Siegmund, A. (2020). *Geography didactics (4th revised and expanded edition)*. Paderborn: Schöningh.
- Scherak, L. & Rieckmann, M. (2020). Developing ESD Competences in Higher Education Institutions: Staff Training at the University of Vechta. *Sustainability*, 12 (24), 10336. doi.org/10.3390/su122410336
- Schmitz, G. & Schwarzer, R. (2002). Individual and collective self-efficacy expectations of teachers. In M. Jerusalem & D. Hopf

- (Hrsg.), Self-efficacy and motivational processes in educational institutions (S. 192-214). Weinheim and Basel: Beltz.
- Shulman, L.S. (1986). Those Who Understand: Knowledge Growth in Teaching. *The Educational Researcher*, 15(2), 4-14.
- Shulman, L.S. (1987). Knowledge and Teaching: Foundations of the New Reform. *Harvard Educational Review*, 57(1), 1-22.
- Terhart, E. (2011). Teaching profession and professionalism: changed understanding of terms - new challenges. In W. Helsper & R. Trippelt (Hrsg.), *Pedagogical professionalism*, 57th supplement to the magazine for pedagogy (S. 202-224). Weinheim: Beltz.
- Tremmel, J. (2004): "Sustainability" - Defined according to a criteria-based procedure. *Ecological Perspectives for Science and Society (GAIA)*, 13(1), 26-34. doi:10.14512/gaia.13.1.6
- United Nations Educational, Scientific and Cultural Organization (UNESCO) (2015). *UNESCO Roadmap for the Implementation of the World Action Program*. https://www.bne-portal.de/files/2015_Roadmap_deutsch.pdf (10.09.20).
- Weschenfelder, E. (2014). *Professional competence of political teachers. A Study of Knowledge and Beliefs*. Wiesbaden: Springer.
- Witt, R. (2009). Pedagogical professionalism and the differentiation of domains in vocational education. In O. Zlatkin-Troitschanskaia, K. Beck, D. Sembill, R. Nickolaus & R. Mulder (Hrsg.), *Teaching professionalism. Conditions, genesis, effects and their measurement* (S. 93-103). Weinheim & Basel: Beltz.
- Wittlich, C. (2021). *Extra-curricular education for sustainable development. A qualitative and quantitative study of the learning location landscape in Rhineland-Palatinate with special consideration of the effectiveness of ESD educational measures*. Dissertation. doi 10.13140/RG.2.2.16579.63522