## **Appendix 1: Publications in each type**

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| **Type 1: Designing Learning Environments (n=31)** |
| Alsop, S., Dippo, D., & Zandvliet, D. B. (2007). Teacher education as or for social and ecological transformation: Place-based reflections on local and global participatory methods and collaborative practices. *Journal of Education for Teaching*, *33*(2), 207–223. <https://doi.org/10.1080/02607470701259499> Bradbery, D. (2013). Bridges to global citizenship: Ecologically sustainable futures utilising children's literature in teacher education. *Australian Journal of Environmental Education*, *29*(2), 221–237. <https://doi.org/10.1017/aee.2014.7> Burmeister, M., & Eilks, I. (2013). Using participatory action research to develop a course module on education for sustainable development in pre-service chemistry teacher education. *Center for Educational Policy Studies Journal*, *3*(1), 59–78.Chin, C. K., Munip, H., Miyadera, R., Thoe, N. K., Ch'ng, Y. S., & Promsing, N. (2019). Promoting Education for Sustainable Development in teacher education integrating blended learning and digital tools: An evaluation with exemplary cases. *Eurasia Journal of Mathematics, Science and Technology Education*, *15*(1), em1653. <https://doi.org/10.29333/ejmste/99513> Elsden-Clifton, J., & Futter-Puati, D. (2015). Creating a health and sustainability nexus in food education: Designing third spaces in teacher education. *Australian Journal of Environmental Education*, *31*(1), 86–98. <https://doi.org/10.1017/aee.2014.44> Flaws, M. G., & Meredith, K. L. (2007). A wind shift: Integrating curriculum for education for sustainable development. *New Zealand Geographer*, *63*(1), 55–61. <https://doi.org/10.1111/j.1745-7939.2007.00091.x> Huckle, J. (2012). Teacher education for sustainability in network society: Combining digital and sustainability literacies. *Journal of Teacher Education for Sustainability*, *14*(2), 130–146. <https://doi.org/10.2478/v10099-012-0013-9> Jegstad, K. M., Sinnes, A. T., & Gjøtterud, S. M. (2018). Science teacher education for sustainable development: from intensions to realisation. *Nordina*, *14*(4), 350–367. <https://doi.org/10.5617/nordina.3263> Kadji-Beltran, C., Christodoulou, N., Zachariou, A., Lindemann-Matthies, P., Barker, S., & Kadis, C. (2017). An ESD pathway to quality education in the Cyprus primary education context. *Environmental Education Research*, *23*(7), 1015–1031. <https://doi.org/10.1080/13504622.2016.1249459> Kanga, A. W. (2016). A teaching philosophy: A prerequisite for effective pedagogical practices in teacher education. In *Handbook of Research on Global Issues in Next-Generation Teacher Education* (pp. 123–137). <https://doi.org/10.4018/978-1-4666-9948-9.ch007> Karpudewan, M., Ismail, Z. H., & Mohamed, N. (2009). The integration of green chemistry experiments with sustainable development concepts in pre-service teachers' curriculum: Experiences from Malaysia. *International Journal of Sustainability in Higher Education*, *10*(2), 118–135. <https://doi.org/10.1108/14676370910945936> Kennelly, J., & Taylor, N. (2007). Education for Sustainability for the K-6 Curriculum: A Unit of Work for Pre-Service Primary Teachers in NSW. *Australian Journal of Environmental Education*, *23*(2), 3–12. <https://doi.org/10.1017/S0814062600000665> Kissling, M. T. (2016). Place-Based Social Studies Teacher Education: Learning to Teach for Ecological Citizenship While Investigating Local Waste Issues. In A. R. Crowe & A. Cuenca (Eds.), *Rethinking Social Studies Teacher Education in the Twenty-First Century* (pp. 321–338). Springer. <https://doi.org/10.1007/978-3-319-22939-3_17> Lindemann‐Matthies, P., Constantinou, C., Junge, X., Köhler, K., Mayer, J., Nagel, U., Raper, G., Schüle, D., & Kadji‐Beltran, C. (2009). The integration of biodiversity education in the initial education of primary school teachers: four comparative case studies from Europe. *Environmental Education Research*, *15*(1), 17–37. <https://doi.org/10.1080/13504620802613496> Maguire, H., Mc Cloat, A., O'Donoghue, M., & Cusack, M. (2013). Images and objects a tool for teaching education for sustainable development and responsible living in home economics. In D. Doyle, V. Fricke, U. Schrader, & V. W. Thoresen (Eds.), *Enabling Responsible Living* (pp. 133–146). Springer. <https://doi.org/10.1007/978-3-642-22048-7_10> Makrakis, V. (2017). Unlocking the potentiality and actuality of icts in developing sustainability-justice curricula and society. *Knowledge Cultures*, *5*(2), 103–122. <https://doi.org/10.22381/KC5220177> Nielsen, W., Andersen, P., Hurley, A., Sabljak, V., Petereit, A.‑L., Hoskin, V., & Hoban, G. (2012). Preparing action competent environmental educators: How hard could it be? *Australian Journal of Environmental Education*, *28*(2), 92–107. <https://doi.org/10.1017/aee.2013.3> O’Gorman, L. (2014). The Arts and education for sustainability: Shaping student teachers’ identities towards sustainability. In J. Davis & S. Elliott (Eds.), *Research in early childhood education for sustainability: International perspectives and provocations* (pp. 266–279). Routledge.O'Brien, C. (2013). Happiness and sustainability together at last! Sustainable happiness. *Canadian Journal of Education*, *36*(4), 228–256.O'Gorman, L., & Davis, J. (2013). Ecological footprinting: Its potential as a tool for change in preservice teacher education. *Environmental Education Research*, *19*(6), 779–791. <https://doi.org/10.1080/13504622.2012.749979> Østergaard, E. (2017). Earth at Rest: Aesthetic Experience and Students’ Grounding in Science Education. *Science and Education*, *26*(5), 557–582. <https://doi.org/10.1007/s11191-017-9906-2> Paige, K., Lloyd, D., & Smith, R. (2016). Pathway to 'Knowing Places' - And Ecojustice - Three Teacher Educators' Experiences. *Australian Journal of Environmental Education*, *32*(3), 260–287. <https://doi.org/10.1017/aee.2016.18> Rasmussen, K. (2017). The emergence and institutional co-determination of sustainability as a teaching topic in interdisciplinary science teacher education. *Environmental Education Research*, *23*(3), 348–364. <https://doi.org/10.1080/13504622.2016.1182625> Rodgers, C. R. (2006). "The turning of one's soul" - Learning to teach for social justice: The Putney Graduate School of Teacher Education (1950-1964). *Teachers College Record*, *108*(7), 1266–1295. <https://doi.org/10.1111/j.1467-9620.2006.00693.x> Shallcross, T., & Wilkinson, G. (1998). The primacy of action: The basis of initial teacher education for sustainability? *Environmental Education and Information*, *17*(3), 243–256.Smorti, S., Peters-Algie, M., & Rau, C. (2013). Engaging student teachers in sustainable praxis in Aotearoa/New Zealand. *Journal of Teacher Education for Sustainability*, *15*(1), 5–14. <https://doi.org/10.2478/jtes-2013-0001> Stears, M., & James, A. (2011). Towards socially responsible biology: Two cases in a teacher education programme. *African Journal of Research in Mathematics, Science and Technology Education*, *15*(3), 122–136. <https://doi.org/10.1080/10288457.2011.10740722> Stevahn, L., & McGuire, M. E. (2017). The plot thickens: Supporting pre-service teachers in authentic use of cooperative learning through the Storypath instructional approach. *Journal of Education for Teaching*, *43*(3), 316–327. <https://doi.org/10.1080/02607476.2017.1321674> Thaman, K. H. (2010). Teacher capacities for working towards peace and sustainable development. *International Journal of Sustainability in Higher Education*, *11*(4), 353–364. <https://doi.org/10.1108/14676371011077577> Vare, P., Arro, G., Hamer, A. de, Del Gobbo, G., Vries, G. de, Farioli, F., Kadji-Beltran, C., Kangur, M., Mayer, M., Millican, R., Nijdam, C., Réti, M., & Zachariou, A. (2019). Devising a Competence-Based Training Program for Educators of Sustainable Development: Lessons Learned. *Sustainability*, *11*(7), 1890. <https://doi.org/10.3390/su11071890> Varga, A., Kószó, M. F., Mayer, M., & Sleurs, W. (2007). Developing teacher competences for education for sustainable development through reflection: The Environment and School Initiatives approach. *Journal of Education for Teaching*, *33*(2), 241–256. <https://doi.org/10.1080/02607470701259564>  |
| **Type 2: Understanding Learner Attributes (n=39)** |
| Akça, F. (2019). Sustainable Development in Teacher Education in Terms of Being Solution Oriented and Self-Efficacy. *Sustainability*, *11*(23), 6878. <https://doi.org/10.3390/su11236878> Alkaher, I., & Goldman, D. (2018). Characterizing the motives and environmental literacy of undergraduate and graduate students who elect environmental programs–a comparison between teaching-oriented and other students. *Environmental Education Research*, *24*(7), 969–999. <https://doi.org/10.1080/13504622.2017.1362372> Andersson, K. (2017). Starting the pluralistic tradition of teaching? Effects of education for sustainable development (ESD) on pre-service teachers’ views on teaching about sustainable development. *Environmental Education Research*, *23*(3), 436–449. <https://doi.org/10.1080/13504622.2016.1174982> Andić, D., & Vorkapić, S. T. (2017). Teacher Education for Sustainability: The Awareness and Responsibility for Sustainability Problems. *Journal of Teacher Education for Sustainability*, *19*(2), 121–137. <https://doi.org/10.1515/jtes-2017-0018> Ärlemalm-Hagsér, E. (2017). Student Teachers’ Workplace-Based Learning in Sweden on Early Childhood Education for Sustainability: Experiences in Practice Settings. *International Journal of Early Childhood*, *49*(3), 411–427. <https://doi.org/10.1007/s13158-017-0201-9> Buchanan, J., & Griffin, J. (2010). Finding a place for environmental studies: Tertiary institutions as a locus of practice for education for sustainability. *Journal of Teacher Education for Sustainability*, *12*(2), 5–16. <https://doi.org/10.2478/v10099-009-0050-1> Burmeister, M., Schmidt-Jacob, S., & Eilks, I. (2013). German chemistry teachers' understanding of sustainability and education for sustainable development - An interview case study. *Chemistry Education Research and Practice*, *14*(2), 169–176. <https://doi.org/10.1039/c2rp20137b> Büssing, A. G., Schleper, M., & Menzel, S. (2019). Emotions and pre-service teachers’ motivation to teach the context of returning wolves. *Environmental Education Research*, *25*(8), 1174–1189. <https://doi.org/10.1080/13504622.2018.1487034> Cebrián, G., & Junyent, M. (2015). Competencies in education for sustainable development: Exploring the student teachers' views. *Sustainability (Switzerland)*, *7*(3), 2768–2786. <https://doi.org/10.3390/su7032768> Cebrián, G., Pascual, D., & Moraleda, Á. (2019). Perception of sustainability competencies amongst Spanish pre-service secondary school teachers. *International Journal of Sustainability in Higher Education*, *20*(7), 1171–1190. <https://doi.org/10.1108/IJSHE-10-2018-0168> Corney, G. (2006). Education for sustainable development: An empirical study of the tensions and challenges faced by geography student teachers. *International Research in Geographical and Environmental Education*, *15*(3), 224–240. <https://doi.org/10.2167/irgee194.0> Dyment, J. E., & Hill, A. (2015). You mean I have to teach sustainability too? Initial teacher education students' perspectives on the sustainability cross-curriculum priority. *Australian Journal of Teacher Education*, *40*(3), 21–35. <http://dx.doi.org/10.14221/ajte.2014v40n3.2> Elshof, L. (2005). Teacher's interpretation of sustainable development. *International Journal of Technology and Design Education*, *15*(2), 173–186. <https://doi.org/10.1007/s10798-005-8277-1> Esa, N. (2010). Environmental knowledge, attitude and practices of student teachers. *International Research in Geographical and Environmental Education*, *19*(1), 39–50. <https://doi.org/10.1080/10382040903545534> Gedžune, I., & Gedžune, G. (2011). Exploring and promoting ecological consciousness in teacher education: The possibilities of educational action research in education for sustainable development. *Journal of Teacher Education for Sustainability*, *13*(1), 43–61. <https://doi.org/10.2478/v10099-011-0004-2> Guseva, S., Dombrovskis, V., & Capulis, S. (2015). Unity of affect and intellect for future teachers' education sustainable development. *International Journal of Learning in Higher Education*, *22*(2), 29–35. <https://doi.org/10.18848/2327-7955/CGP/v22i02/48616> Gwekwerere, Y. (2015). Pre-service teachers' knowledge, participation and perceptions about environmental education in schools. *Australian Journal of Environmental Education*, *30*(2), 198–214. <https://doi.org/10.1017/aee.2015.15> Kalsoom, Q., Khanam, A., & Quraishi, U. (2017). Sustainability consciousness of pre-service teachers in Pakistan. *International Journal of Sustainability in Higher Education*, *18*(7), 1090–1107. <https://doi.org/10.1108/IJSHE-11-2016-0218> Kang, W. (2019). Perceived Barriers to Implementing Education for Sustainable Development among Korean Teachers. *Sustainability*, *11*(9), 2532. <https://doi.org/10.3390/su11092532> Kennelly, J., Taylor, N., & Maxwell, T. (2008). A Student Teacher's Personal Pathway to Education for Sustainability. *Australian Journal of Environmental Education*, *24*(2), 23–33. <https://doi.org/10.1017/S0814062600000550> Lindemann-Matthies, P., Constantinou, C., Lehnert, H.‑J., Nagel, U., Raper, G., & Kadji-Beltran, C. (2011). Confidence and Perceived Competence of Preservice Teachers to Implement Biodiversity Education in Primary Schools-Four comparative case studies from Europe. *International Journal of Science Education*, *33*(16), 2247–2273. <https://doi.org/10.1080/09500693.2010.547534> Lummis, G. W., Morris, J. E., Lock, G., & Odgaard, J. (2015). Where Western Australian graduate diploma of education primary students source their information on sustainability. *Australian Journal of Teacher Education*, *40*(10), 51–65. <https://doi.org/10.14221/ajte.2015v40n10.4> Lummis, G. W., Morris, J. E., Lock, G., & Odgaard, J. (2017). The influence of ecological citizenship and political solidarity on Western Australian student teachers’ perceptions of sustainability issues. *International Research in Geographical and Environmental Education*, *26*(2), 135–149. <https://doi.org/10.1080/10382046.2016.1235359> Martin, J., & Carter, L. (2015). Preservice teacher agency concerning education for sustainability (EfS): A discursive psychological approach. *Journal of Research in Science Teaching*, *52*(4), 560–573. <https://doi.org/10.1002/tea.21217> Martínez-Borreguero, G., Maestre-Jiménez, J., Mateos-Núñez, M., & Naranjo-Correa, F. L. (2019). Knowledge Analysis of the Prospective Secondary School Teacher on a Key Concept in Sustainability: Waste. *Sustainability*, *11*(4), 1173. <https://doi.org/10.3390/su11041173> Nikel, J. (2007). Making sense of education ‘responsibly’: findings from a study of student teachers' understanding(s) of education, sustainable development and Education for Sustainable Development. *Environmental Education Research*, *13*(5), 545–564. <https://doi.org/10.1080/13504620701430778> Odgers, B. M. (2009). Incorporating education for sustainability into a pre-service elementary school teachers' program. *International Journal of Learning*, *16*(9), 401–418. Palmberg, I., Berg, I., Jeronen, E., Kärkkäinen, S., Norrgård-Sillanpää, P., Persson, C., Vilkonis, R., & Yli-Panula, E. (2015). Nordic–baltic Student Teachers’ Identification of and Interest in Plant and Animal Species: The Importance of Species Identification and Biodiversity for Sustainable Development. *Journal of Science Teacher Education*, *26*(6), 549–571. <https://doi.org/10.1007/s10972-015-9438-z> Palmberg, I., Hermans, M., Jeronen, E., Kärkkäinen, S., Persson, C., & Yli-Panula, E. (2018). Nordic Student Teachers’ Views on the Importance of Species and Species Identification. *Journal of Science Teacher Education*, *29*(5), 397–419. <https://doi.org/10.1080/1046560X.2018.1468167> Panatsa, V. M., & Malandrakis, G. (2018). Student teachers’ perceptions about the social pillar of urban sustainability: Attached importance and believed effectiveness of education. *International Journal of Sustainability in Higher Education*, *19*(5), 998–1018. <https://doi.org/10.1108/IJSHE-09-2017-0162> Quinn, F., Castéra, J., & Clément, P. (2016). Teachers’ conceptions of the environment: Anthropocentrism, non-anthropocentrism, anthropomorphism and the place of nature. *Environmental Education Research*, *22*(6), 893–917. <https://doi.org/10.1080/13504622.2015.1076767> Raus, R., & Falkenberg, T. (2014). The journey towards a teacher's ecological self: A case study of a student teacher. *Journal of Teacher Education for Sustainability*, *16*(2), 103–114. <https://doi.org/10.2478/jtes-2014-0014> Sahin, E., & Alici, S. (2019). An associational study on pre-service early childhood teachers’ nature relatedness in education for sustainability. *International Research in Geographical and Environmental Education*, *28*(4), 343–357. <https://doi.org/10.1080/10382046.2019.1651040> Salite, I. (2008). Educational action research for sustainability: Constructing a vision for the future in teacher education. *Journal of Teacher Education for Sustainability*, *10*, 5–16. <https://doi.org/10.2478/v10099-009-0021-6> Summers, M., Childs, A., & Corney, G. (2005). Education for sustainable development in initial teacher training: issues for interdisciplinary collaboration. *Environmental Education Research*, *11*(5), 623–647. <https://doi.org/10.1080/13504620500169841> Summers, M., Kruger, C., Childs, A., & Mant, J. (2001). Understanding the science of environmental issues: Development of a subject knowledge guide for primary teacher education. *International Journal of Science Education*, *23*(1), 33–53. <https://doi.org/10.1080/09500690116990> Vongalis-Macrow, A. (2010). Developing pedagogies for teaching about climate change. *International Journal of Learning*, *17*(9), 237–248. Waldron, F., Ruane, B., Oberman, R., & Morris, S. (2019). Geographical process or global injustice? Contrasting educational perspectives on climate change. *Environmental Education Research*, *25*(6), 895–911. <https://doi.org/10.1080/13504622.2016.1255876> Yavetz, B., Goldman, D., & Pe'er, S. (2014). How do preservice teachers perceive 'environment' and its relevance to their area of teaching? *Environmental Education Research*, *20*(3), 354–371. <https://doi.org/10.1080/13504622.2013.803038>  |
| **Type 3: Measuring Learning Outcomes (n=42)** |
| Alvarez-García, O., Sureda-Negre, J., & Comas-Forgas, R. (2018). Assessing environmental competencies of primary education pre-service teachers in Spain: A comparative study between two universities. *International Journal of Sustainability in Higher Education*, *19*(1), 15–31. <https://doi.org/10.1108/IJSHE-12-2016-0227> America, C. (2014). Integrating sustainability into business education teacher training. *South African Journal of Education*, *34*(3). <https://doi.org/10.15700/201409161105> Andersson, K., Jagers, S. C., Lindskog, A., & Martinsson, J. (2013). Learning for the future: Effects of education for sustainable development (ESD) on teacher education students. *Sustainability (Switzerland)*, *5*(12), 5135–5152. <https://doi.org/10.3390/su5125135> Andić, D., & Vorkapić, S. T. (2014). Interdisciplinary approaches to sustainable development in higher education: A case study from Croatia. In K. D. Thomas & H. E. Muga (Eds.), Handbook of Research on Pedagogical Innovations for Sustainable Development (pp. 67–115). IGI Global. <https://doi.org/10.4018/978-1-4666-5856-1.ch005> Brandt, J.‑O., Bürgener, L., Barth, M., & Redman, A. (2019). Becoming a competent teacher in education for sustainable development. *International Journal of Sustainability in Higher Education*, *20*(4), 630–653. <https://doi.org/10.1108/IJSHE-10-2018-0183> Brendel, N., Aksit, F., Aksit, S., & Schrüfer, G. (2016). Multicultural group work on field excursions to promote student teachers’ intercultural competence. *Journal of Geography in Higher Education*, *40*(2), 284–301. <https://doi.org/10.1080/03098265.2016.1140731> Brinia, V., Psoni, P., & Ntantasiou, E.‑K. (2019). How to Instill Cultural Values in the New Generation through Cultural Promenades and Ancient Drama: A Field Research. *Sustainability*, *11*(6), 1758. <https://doi.org/10.3390/su11061758> Bürgener, L., & Barth, M. (2018). Sustainability competencies in teacher education: Making teacher education count in everyday school practice. *Journal of Cleaner Production*, *174*, 821–826. <https://doi.org/10.1016/j.jclepro.2017.10.263> Corney, G., & Reid, A. (2007). Student teachers' learning about subject matter and pedagogy in education for sustainable development. *Environmental Education Research*, *13*(1), 33–54. <https://doi.org/10.1080/13504620601122632> Elster, D., Müller, N., & Drachenberg, S. (2017). Promotion of system competence based on the syndrome approach in pre-service biology teacher education. In L. Leite, L. Dourado, A. S. Afonso, & S. Morgado (Eds.), *Contextualizing Teaching to Improve Learning: The Case of Science and Geography* (pp. 123–142). Nova Science Publishers.Esteve-Guirao, P., García, M. J., & Banos-González, I. (2019). The Interdependences between Sustainability and Their Lifestyle That Pre-Service Teachers Establish When Addressing Socio-Ecological Problems. *Sustainability*, *11*(20), 5748. <https://doi.org/10.3390/su11205748> Feriver, Ş., Teksöz, G., Olgan, R., & Reid, A. (2016). Training early childhood teachers for sustainability: Towards a ‘learning experience of a different kind’. *Environmental Education Research*, *22*(5), 717–746. <https://doi.org/10.1080/13504622.2015.1027883> Ferreira, J.‑A., Ryan, L., & Davis, J. (2015). Developing Knowledge and Leadership in Pre-Service Teacher Education Systems. *Australian Journal of Environmental Education*, *31*(2), 194–207. <https://doi.org/10.1017/aee.2015.24> Ferreira, M. E., André, A. C., & Pitarma, R. (2019). Potentialities of Thermography in Ecocentric Education of Children: An Experience on Training of Future Primary Teachers. *Sustainability*, *11*(9), 2668. <https://doi.org/10.3390/su11092668> Gedžūne, G., & Gedžūne, I. (2015). Pre-service teachers’ aesthetic learning about inclusion and exclusion. *International Journal of Sustainability in Higher Education*, *16*(1), 72–95. <https://doi.org/10.1108/IJSHE-10-2012-0097> Goldman, D., Yavetz, B., & Pe'er, S. (2014). Student teachers' attainment of environmental literacy in relation to their disciplinary major during undergraduate studies. *International Journal of Environmental and Science Education*, *9*(4), 369–383. <https://doi.org/10.12973/ijese.2014.222a> Hale, A. E., Shelton, C. C., Richter, J., & Archambault, L. M. (2017). Integrating geoscience and sustainability: Examining socio-techno-ecological relationships within content designed to prepare teachers. *Journal of Geoscience Education*, *65*(2), 101–112. <https://doi.org/10.5408/16-177.1> Jegstad, K. M., Gjøtterud, S. M., & Sinnes, A. T. (2018). Science teacher education for sustainable development: A case study of a residential field course in a Norwegian pre-service teacher education programme. *Journal of Adventure Education and Outdoor Learning*, *18*(2), 99–114. <https://doi.org/10.1080/14729679.2017.1374192> Kadji-Beltran, C., Zachariou, A., Liarakou, G., & Flogaitis, E. (2014). Mentoring as a strategy for empowering Education for Sustainable Development in schools. *Professional Development in Education*, *40*(5), 717–739. <https://doi.org/10.1080/19415257.2013.835276> Kalsoom, Q., & Khanam, A. (2017). Inquiry into sustainability issues by preservice teachers: A pedagogy to enhance sustainability consciousness. *Journal of Cleaner Production*, *164*, 1301–1311. <https://doi.org/10.1016/j.jclepro.2017.07.047> Karlström, M., & Hamza, K. (2018). Preservice Science Teachers’ Opportunities for Learning Through Reflection When Planning a Microteaching Unit. *Journal of Science Teacher Education.* Advance online publication. <https://doi.org/10.1080/1046560X.2018.1531345> Kennelly, J., Taylor, N., & Serow, P. (2012). Early career primary teachers and education for sustainability. *International Research in Geographical and Environmental Education*, *21*(2), 139–153. <https://doi.org/10.1080/10382046.2012.672680> Kostoulas-Makrakis, N. (2010). Developing and applying a critical and transformative model to address education for sustainable development in teacher education. *Journal of Teacher Education for Sustainability*, *12*(2), 17–26. <https://doi.org/10.2478/v10099-009-0051-0> Lasen, M., Tomas, L., & Hill, A. (2015). Potential of service-learning to promote sustainability competencies in pre-service teachers: A case study. *Teaching Education*, *26*(4), 341–365. <https://doi.org/10.1080/10476210.2015.1018157> McNaughton, M. J. (2012). Implementing Education for Sustainable Development in schools: Learning from teachers' reflections. *Environmental Education Research*, *18*(6), 765–782. <https://doi.org/10.1080/13504622.2012.665850> Merritt, E., Hale, A., & Archambault, L. (2018). Changes in pre-service teachers' values, sense of agency, motivation and consumption practices: A case study of an education for sustainability course. *Sustainability (Switzerland)*, *11*(1). <https://doi.org/10.3390/su11010155> Nousheen, A., Yousuf Zai, S. A., Waseem, M., & Khan, S. A. (2020). Education for sustainable development (ESD): Effects of sustainability education on pre-service teachers’ attitude towards sustainable development (SD). *Journal of Cleaner Production*, *250*, 119537. <https://doi.org/10.1016/j.jclepro.2019.119537> Paige, K. (2011). Citizen science, critical numeracy and place-based learning: Practices for connecting pre-service primary/middle teachers to community and place, *The International Journal of Environmental, Cultural, Economic, and Social Sustainability: Annual Review, 7*(3), 11–26. <https://doi.org/10.18848/1832-2077/CGP/v07i03/54720> Paige, K. (2014). Sustainability practices in a fourth year mathematics and science Pre-Service Primary/Middle pathway course. *International Journal of Sustainability Education*, *9*(4), 1–16. <https://doi.org/10.18848/2325-1212/CGP/v09i04/55310> Richter-Beuschel, L., Grass, I., & Bögeholz, S. (2018). How to Measure Procedural Knowledge for Solving Biodiversity and Climate Change Challenges. *Education Sciences*, *8*(4), 190. <https://doi.org/10.3390/educsci8040190> Rosenkränzer, F., Hörsch, C., Schuler, S., & Riess, W. (2017). Student teachers’ pedagogical content knowledge for teaching systems thinking: Effects of different interventions. *International Journal of Science Education*, *39*(14), 1932–1951. <https://doi.org/10.1080/09500693.2017.1362603> Schuler, S., Fanta, D., Rosenkraenzer, F., & Riess, W. (2018). Systems thinking within the scope of education for sustainable development (ESD)–a heuristic competence model as a basis for (science) teacher education. *Journal of Geography in Higher Education*, *42*(2), 192–204. <https://doi.org/10.1080/03098265.2017.1339264> Sjögren, H. (2019). More of the same: A critical analysis of the formations of teacher students through education for sustainable development. *Environmental Education Research*, *25*(11), 1620–1634. <https://doi.org/10.1080/13504622.2019.1675595> Spahiu, M. H., & Lindemann-Matthies, P. (2015). Effect of a toolkit and a one-day teacher education workshop on ESD teaching content and methods-A study from Kosovo. *Sustainability (Switzerland)*, *7*(7), 8051–8066. <https://doi.org/10.3390/su7078051> Straková, Z., & Cimermanová, I. (2018). Critical thinking development-a necessary step in higher education transformation towards sustainability. *Sustainability (Switzerland)*, *10*(10). <https://doi.org/10.3390/su10103366> Sundberg, B., & Ottander, C. (2014). Science in preschool - a foundation for education for sustainability? A view from Swedish preschool teacher education. In J. Davis & S. Elliott (Eds.), *Research in early childhood education for sustainability: International perspectives and provocations* (pp. 280–293). Routledge. Tomas, L., Girgenti, S., & Jackson, C. (2017). Pre-service teachers’ attitudes toward education for sustainability and its relevance to their learning: Implications for pedagogical practice. *Environmental Education Research*, *23*(3), 324–347. <https://doi.org/10.1080/13504622.2015.1109065> Tomas, L., Lasen, M., Field, E., & Skamp, K. (2015). Promoting online students' engagement and learning in science and sustainability preservice teacher education. *Australian Journal of Teacher Education*, *40*(11), 78–107. <https://doi.org/10.14221/ajte.2015v40n11.5> van Rooy, W. (2017). Early Preservice Teachers' Experiences of the Environment: A Case Study of Participation in a Community Outdoor Event. *Australian Journal of Environmental Education*, *33*(2), 81–96. <https://doi.org/10.1017/aee.2017.21> Walshe, N., & Tait, V. (2019). Making connections: a conference approach to developing transformative environmental and sustainability education within initial teacher education. *Environmental Education Research*, *25*(12), 1731–1750. <https://doi.org/10.1080/13504622.2019.1677858> Weiland, I. S., & Morrison, J. A. (2013). The Integration of Environmental Education into Two Elementary Preservice Science Methods Courses: A Content-Based and a Method-Based Approach. *Journal of Science Teacher Education*, *24*(6), 1023–1047. <https://doi.org/10.1007/s10972-013-9336-1> Weller, J. (2019). Primary Science Preservice Teacher (PST) Online Publishing: Is It Recognized as Valuable? *Journal of Science Teacher Education*, *30*(7), 716–736. <https://doi.org/10.1080/1046560X.2019.1602802>  |
| **Type 4: Promoting Systems Change (n=35)** |
| Almeida, S. (2017). Policy-Makers' and Practitioners' perspectives on impact, evidence, and support for teacher educators implementing environmental education for sustainability in India. In J. G. Nuttall, A. Kostogriz, M. Jones, & J. Martin (Eds.), *Teacher education policy and practice: Evidence of impact, impact of evidence (*pp. 35–48). Springer. <https://doi.org/10.1007/978-981-10-4133-4_3> Avissar, I., Alkaher, I., & Gan, D. (2018). The role of distributed leadership in mainstreaming environmental sustainability into campus life in an Israeli teaching college: A case study. *International Journal of Sustainability in Higher Education*, *19*(3), 518–546. <https://doi.org/10.1108/IJSHE-07-2017-0105> Bamber, P., Bullivant, A., Glover, A., King, B., & McMcCann, G. (2016). A comparative review of policy and practice for education for sustainable development/education for global citizenship (ESD/GC) in teacher education across the four nations of the UK. *Management in Education*, *30*(3), 112–120. <https://doi.org/10.1177/0892020616653179> Chinedu, C. C., Wan Mohamed, W. A., Ajah, A. O., & Tukur, Y. A. (2019). Prospects of a technical and vocational education program in preparing pre-service teachers for sustainability: a case study of a TVE program in Kuala Lumpur, Malaysia. *Curriculum Perspectives*, *39*(1), 33–46. <https://doi.org/10.1007/s41297-018-0046-x> Dahl, T. (2019). Prepared to Teach for Sustainable Development? Student Teachers’ Beliefs in Their Ability to Teach for Sustainable Development. *Sustainability*, *11*(7), 1993. <https://doi.org/10.3390/su11071993> Davis, J., & Ferreira, J.‑A. (2017). Creating Change for Sustainability in Universities in Australia, One System at a Time. In W. Leal Filho, L. Brandli, P. Castro, & J. Newman (Eds.), *World Sustainability Series. Handbook of Theory and Practice of Sustainable Development in Higher Education* (pp. 217–230). Springer. <https://doi.org/10.1007/978-3-319-47868-5_14> Dippo, D. (2013). Preservice teaching and pedagogies of transformation. In R. McKeown & V. Nolet (Eds.), *Schooling for sustainable development in Canada and the United States* (pp. 69–78). Springer. <https://doi.org/10.1007/978-94-007-4273-4_5> Down, L., & Nurse, H. (2007). Education for sustainable development networks, potential and challenge: A critical reflection on the formation of the Caribbean Regional Network. *Journal of Education for Teaching*, *33*(2), 177–190. <https://doi.org/10.1080/02607470701259473> Emery, S., Davis, J. M., Sageidet, B. M., & Hirst, N. (2017). Transnational Dialogues for Sustainability Research in Early Childhood Education: A Model for Building Capacity for ESD in Universities? In W. Leal Filho, C. Skanavis, A. do Paço, J. Rogers, O. Kuznetsova, & P. Castro (Eds.), *Handbook of Theory and Practice of Sustainable Development in Higher Education* (pp. 143-156). Springer. <https://doi.org/10.1007/978-3-319-47889-0_11> Falkenberg, T., & Babiuk, G. (2014). The status of education for sustainability in initial teacher education programmes: A Canadian case study. *International Journal of Sustainability in Higher Education*, *15*(4), 418–430. <https://doi.org/10.1108/IJSHE-10-2012-0088> Ferreira, J.‑A., & Davis, J. M. (2010). Creating deep and broad change through research and systems approaches in early childhood education for sustainability. In J. Davis (Ed.), *Young children and the environment: Early education for sustainability* (pp. 273–291). Cambridge University Press. <https://doi.org/10.1017/CBO9780511845390.011> Ferreira, J.‑A., Ryan, L., & Tilbury, D. (2007). Mainstreaming education for sustainable development in initial teacher education in Australia: A review of existing professional development models. *Journal of Education for Teaching*, *33*(2), 225–239. <https://doi.org/10.1080/02607470701259515> Fien, J. (1995). Teaching for a Sustainable World: The Environmental and Development Education Project for Teacher Education. *Environmental Education Research*, *1*(1), 21–33. <https://doi.org/10.1080/1350462950010102> Fien, J. (2001). The Learning for a Sustainable Environment Project: A Case Study of an Action Network for Teacher Education. *Australian Journal of Environmental Education*, *17*(1), 77–86. <https://doi.org/10.1017/S0814062600002470> Fien, J., & Corcoran, P. B. (1996). Learning for a Sustainable Environment: professional development and teacher education in environmental education in the Asia‐Pacific region. *Environmental Education Research*, *2*(2), 227–236. <https://doi.org/10.1080/1350462960020208> Grabovska, R., & Grabowski, J. (2009). Implementing the United Nations Decade on Education for Sustainable Development in Latvian Higher Education. *Journal of Teacher Education for Sustainability*, *11*(1), 18–30. <https://doi.org/10.2478/v10099-009-0029-y> Green, M., & Somerville, M. (2015). Sustainability education: Researching practice in primary schools. *Environmental Education Research*, *21*(6), 832–845. <https://doi.org/10.1080/13504622.2014.923382> Inman, S., Mackay, S., Rogers, M., & Wade, R. (2010). Effecting change through learning networks: The experience of the UK teacher education network for education for sustainable development and global citizenship. *Journal of Teacher Education for Sustainability*, *12*(2), 97–109. <https://doi.org/10.2478/v10099-009-0057-7> Isa, M. U., Kamin, Y. B., & Cledumas, A. M. (2019). Refocusing Technical Vocational Teacher Education Towards Green Skill Acquisition for Sustainable Development in Nigeria. *International Journal of Recent Technology and Engineering*, *8*(1C2), 599–602.Kennelly, J., Taylor, N., & Serow, P. (2011). Education for sustainability and the australian curriculum. *Australian Journal of Environmental Education*, *27*(2), 209–218. <https://doi.org/10.1375/ajee.27.2.209> Kibuka-Sebitosi, E. (2015). Towards a model for international collaboration and partnerships in teacher education in Africa: Education for sustainable development in South Africa. *International Journal of African Renaissance Studies*, *10*(2), 104–124. <https://doi.org/10.1080/18186874.2015.1107983> Kieu, T. K., Singer, J., & Gannon, T. J. (2016). Education for sustainable development in Vietnam: Lessons learned from teacher education. *International Journal of Sustainability in Higher Education*, *17*(6), 853–874. <https://doi.org/10.1108/IJSHE-05-2015-0098> Lloyd, D. G., Smith, R., & Paige, K. (2011). Education and sustainability in teacher education: First moves and pedagogy, *The International Journal of Environmental, Cultural, Economic, and Social Sustainability: Annual Review, 7*(3), 65–90. <https://doi.org/10.18848/1832-2077/CGP/v07i03/54727> Lynch, T. (2016). United nations sustainable development goals: Promoting health and well-being through physical education partnerships. *Cogent Education*, *3*(1). <https://doi.org/10.1080/2331186X.2016.1188469> Martin, K., Summers, D., & Sjerps‐Jones, H. (2007). Sustainability and teacher education. *Journal of Further and Higher Education*, *31*(4), 351–362. <https://doi.org/10.1080/03098770701625738> McKeown, R., & Hopkins, C. (2007). International network of teacher education institutions: Past, present and future. *Journal of Education for Teaching*, *33*(2), 149–155. <https://doi.org/10.1080/02607470701259408> Mills, R., & Tomas, L. (2013). Integrating education for sustainability in preservice teacher education: A case study from a regional australian university. *Australian Journal of Environmental Education*, *29*(2), 152–164. <https://doi.org/10.1017/aee.2014.3> Namafe, C. M. (2015). Next Steps at the University of Zambia in Implementing ESD. *Applied Environmental Education and Communication*, *14*(2), 121–125. <https://doi.org/10.1080/1533015X.2014.998796> Ololube, N. P., Egbezor, D. E., & Kpolovie, P. J. (2008). Education policies and teacher education programs: Meeting the millennium development goals. *Journal of Teacher Education for Sustainability*, *9*, 21–34. <https://doi.org/10.2478/v10099-009-0016-3> Rauch, F., & Pfaffenwimmer, G. (2015). Education for sustainable development in Austria: Networking for innovation. In R. Jucker & R. Mathar (Eds.), *Schooling for Sustainable Development in Europe: Concepts, Policies and Educational Experiences at the End of the UN Decade of Education for Sustainable Development* (pp. 157–176). Springer. <https://doi.org/10.1007/978-3-319-09549-3_10> Ravindranath, M. J. (2007). Environmental education in teacher education in India: Experiences and challenges in the United Nation's Decade of Education for Sustainable Development. *Journal of Education for Teaching*, *33*(2), 191–206. <https://doi.org/10.1080/02607470701259481> Smith, G. (2011). Developing a sustainability plan at a large U.S. College of Education. *Journal of Teacher Education for Sustainability*, *13*(2), 5–16. <https://doi.org/10.2478/v10099-011-0011-3> Stir, J. (2006). Restructuring teacher education for sustainability: Student involvement through a "strengths model". *Journal of Cleaner Production*, *14*(9-11), 830–836. <https://doi.org/10.1016/j.jclepro.2005.11.051> Wilson, S. (2012). Drivers and blockers: Embedding education for sustainability (EfS) in primary teacher education. *Australian Journal of Environmental Education*, *28*(1), 42–56. <https://doi.org/10.1017/aee.2012.5> Winter, C., & Firth, R. (2007). Knowledge about Education for Sustainable Development: Four case studies of student teachers in English secondary schools. *Journal of Education for Teaching*, *33*(3), 341–358. <https://doi.org/10.1080/02607470701450528>  |
| **Type 5: Advancing Visions for the Field (n=11)** |
| Belousa, I. (2008). Rediscovery of silenced inner wisdom of spirituality: Teachers' voice in the contemporary post-Soviet era. *International Journal of Children's Spirituality*, *13*(1), 39–49. <https://doi.org/10.1080/13644360701834825> Chinedu, C. C., & Mohamed, W. (2017). A document analysis of the visibility of sustainability in TVE teacher education programme: The case of a Malaysian HEI. *Pertanika Journal of Social Sciences and Humanities*, *25*(S), 201–215. Colucci-Gray, L., Perazzone, A., Dodman, M., & Camino, E. (2013). Science education for sustainability, epistemological reflections and educational practices: From natural sciences to trans-disciplinarity. *Cultural Studies of Science Education*, *8*(1), 127–183. <https://doi.org/10.1007/s11422-012-9405-3> Elm, A., & Nordqvist, I. (2019). The research circle - a tool for preschool teachers’ professional learning and preschool development. *European Journal of Teacher Education*, *42*(5), 621–633. <https://doi.org/10.1080/02619768.2019.1652899> Higgins, P., & Kirk, G. (2006). Sustainability education in Scotland: The impact of national and international initiatives on teacher education and outdoor education. *Journal of Geography in Higher Education*, *30*(2), 313–326. <https://doi.org/10.1080/03098260600717414> Katane, I., & Baltušite, R. (2007). Ecological approach for the formation and development of prospective teachers' readiness for the professional activities at Latvian schools. *Transformations in Business and Economics*, *6*(2), 114–132. Nolet, V. (2009). Preparing sustainability-literate teachers. *Teachers College Record*, *111*(2), 409–442. Nolet, V. (2013). Teacher education and ESD in the United States: The vision, challenges, and implementation. In R. McKeown & V. Nolet (Eds.), *Schooling for sustainable development in Canada and the United States* (pp. 53–67). Springer. <https://doi.org/10.1007/978-94-007-4273-4_4> Rauch, F., & Steiner, R. (2013). Competences for Education for Sustainable Development in Teacher Education. *Center for Educational Policy Studies Journal*, *3*(1), 9–24. Scott, W. (1999). Teacher education for sustainability: Critiquing assumptions about purposes and the primacy of action. *Environmental Education and Information*, *18*(2), 105–116. Vega-Marcote, P., & Varela-Losada, M. (2016). Basic Teacher Training Oriented Toward Sustainability: Why and How to Carry It Out Today? In W. Leal Filho & P. Pace (Eds.), *Teaching education for sustainable development at university level* (pp. 83–96). Springer. <https://doi.org/10.1007/978-3-319-32928-4_6>  |