ORIGINAL ARTICLE

Connecting Didactic Approaches and Sustainability Competencies: Evidence from a Teacher Education Institution in Vietnam

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ABSTRACT
Education for Sustainable Development (ESD) necessitates a holistic and transformational approach that includes three dimensions: learning content, pedagogy, and learning outcomes. The integration of sustainable development (SD) into learning content and learning outcomes has attracted increasing attention; however, pedagogy for SD has hardly been examined. This study examines how didactic approaches which are utilized at a teacher education institution (TEI), specifically, Hanoi National University of Education, connect to sustainability competencies. The analysis is based on the theoretical framework and relevant literature in ESD. The results reflect that half of the current didactic approaches at HNUE can promote sustainability competencies at different levels (likely, maybe, and unlikely) with the prevalence of the 'maybe' level. The other approaches are not known to be broadly used in promoting sustainability competencies. This study offers implications for TEIs in advancing their contribution to ESD, especially, in reconsidering didactic approaches to develop sustainability competencies and promote action-oriented, learner-centered, and transformative learning.

1. INTRODUCTION

Education for Sustainable Development (ESD) "enables all individuals to contribute to achieving the Sustainable Development Goals (SDGs) by equipping them with the knowledge and competencies which are needed to not only understand what the SDGs are about but to become engaged in promoting the transformation needed" (UNESCO, 2017, p.8). UNESCO has been the lead global agency on ESD since the United Nations Decade of Education (2005-2014). After the Decade, UNESCO has kept promoting the contribution of education to building a more sustainable world through the Global Action Programme (GAP) and Education for Sustainable Development: Towards achieving the SDGs (ESD for 2030). Both the GAP and ESD for 2030 emphasize the role of teachers as the key agents in implementing ESD. UNESCO also recommends teacher education should be placed at the heart of reorienting education for sustainability (UNESCO, 2005).

ESD demands a holistic and transformational approach that includes three dimensions: learning content, pedagogy, and learning outcomes (Nguyen et al., 2019; Nguyen et al., 2022). The integration of sustainable development (SD) into learning content and learning outcomes has involved an increasing body of literature over the last decades. Indeed, many studies have focused on discussing the integration of sustainability themes into learning content at higher education level (Albareda-Tiana et al., 2018; Krah et al., 2021; Lovren et al., 2020; Lozano & Peattie, 2011; Lozano & Young, 2013; Nguyen, 2022). The incorporation of sustainability competencies in higher education has appealed growing interest from scholars (Barth & Rieckmann, 2012; Brundiers et al., 2021; de Haan, 2010; Lambrechts et al., 2013; Mogensen & Schnack, 2010; Nguyen et al., 2022; Stough et al., 2018; Wiek et al., 2011).

However, pedagogy for SD has hardly been investigated (Lozano et al., 2017). Pedagogical or didactic approaches in teaching sustainability have been addressed in some studies (Figueiró & Raufflet, 2015; Hopkinson & James, 2010; Sprain & Timpson, 2012). Lozano et al. (2017) were among the first to make an effort to examine the relationship between pedagogical approaches and sustainability competencies. This topic until now has been hardly studied with very few exceptions (Lozano et al., 2017, 2019; Wang et al., 2022).

Considering the key role of teachers in implementing ESD and the aforementioned research gap in ESD literature, this study examines the link between didactic approaches and sustainability competencies through a case study in a teacher education institution (TEI) in Vietnam. In this study, a didactic approach is considered the strategies, methods, and various techniques associated with teaching and instruction, meanwhile, pedagogy is concerned with the science of teaching and learning (Nguyen et al., 2022).

2. LITERATURE REVIEW

2.1. Sustainability competencies

The discussion on sustainability competencies is based on the approach of competency-based education which commenced in the late 1990s (Wiek et al. 2011). Sustainability competencies have attracted increasing attention from many scholars and international organizations. Competencies in the context of sustainability have been defined using different terms by different scholars, for example Sustainability skills (McKeown et al., 2002), Shaping competence (Gestaltungskompetenz) (de Haan, 2010), Action competence (Mogensen & Schnack, 2010), Professional Competences for Sustainable Development (Martens, Roorda, & Cörvers, 2010), Key competencies in sustainability (Brundiers et al., 2021; Wiek et al., 2011), Key competencies for sustainability (UNESCO, 2017), Key competencies for sustainable development (Rieckmann, 2012).

Among the competency frameworks in the context of sustainability, the study by Wiek, Withycombe and Redman (2011) was the most referenced. Specifically, key competencies in sustainability include system-thinking competency, anticipatory/futures-thinking competency, normative/values-thinking competency, strategic-thinking competency, and interpersonal/collaborative competency. Wiek et al. (2016) adds integrated problem-solving competency to the framework. Based on this work, Brundiers et al. (2021) refine the framework and propose two additional competencies, namely Implementation competency and Intra-personal/Self-awareness competency. UNESCO (2017), as being the lead global agency in advancing ESD, based on the agreement between scholars (de Haan, 2010; Wiek et al., 2011; Rieckmann, 2012), suggests eight cross-cutting key competencies for sustainability: systems thinking competency, anticipatory competency, normative competency, strategic competency, collaboration competency, critical thinking competency, self-awareness competency, and integrated problem-solving competency. The above-mentioned frameworks have informed program development, implementation, and evaluation to advance sustainability in higher education worldwide.

2.2. Didactic approach for ESD

The global challenges necessitate a fundamental change in the way we think about education's roles in global development (UNESCO, 2017). Thus, it is important to make a fundamental change in our pedagogy and didactic approaches to foster learners' competencies for sustainability (Fortuin & Bush, 2010; Lovren, 2019; Posch & Steiner, 2006; Sprain & Timpson, 2012). ESD demands a holistic pedagogy focusing on learner-centred (Rieckmann, 2018), action-oriented, and transformative learning (UNESCO, 2017; Rieckmann, 2018). A learner-centred pedagogy provides students the autonomy to manage and monitor their learning processes and construct their own knowledge. Action-oriented learning generates a learning environment enabling learners to take actions and reflect on their experiences. Transformative learning promotes students to think critically about existing beliefs, values, cultures, and practices, thereby transforming their views and taking action based on their perspectives (Mezirow, 2000; Sahakian & Seyfang, 2018).

ESD pedagogy requires teachers to transform their role from an expert providing knowledge to a facilitator of the learning process. Accordingly, ESD stresses the need for alternative teaching methods to help students participate actively, think critically, and make reflections. Some authors discuss a wide range of alternative teaching methods for conveying sustainability such as cased-based approach, problem-based learning, project-oriented learning, a cross-disciplinary workshop, action-oriented, experiential learning, service learning, etc. Specifically, Cotton and Winter (2010) define sustainability pedagogies including role-plays and simulations; group discussions; stimulus

activities; debates; critical incidents (students are given an example and asked what they would do, what they could do, and what they should do); case studies; reflexive accounts; personal development planning; critical reading and writing; problem-based learning; fieldwork; and modeling good practice. Ceulemans and De Prins (2010) suggest student-activating methods that can be used in the classroom to address sustainability such as videos, brainstorming, case studies, demonstrations, forms of dialogue, teamwork, jigsaw, assignments, problem-oriented education, oral presentations, project learning, small discussion groups, voting, and questions. Lambrechts et al. (2013) recommend three teaching approaches to promote SD competencies, namely interactive and participative methods (the Socratic method, group discussion, role play, group or personal diaries, brainstorming, and peer assessment); action oriented methods (learning through internships, solving real community problems, and outdoor education); and research methods (bibliographic research, problem analysis, value clarification, case studies, and concept mapping). Gugerell and Zuidema (2016) propose gamification to address sustainability. Gordon and Thomas (2018) recommend role-play as a powerful technique to developing sustainability competencies. Annelin (2021) examines the positive impacts of experiential learning on sustainability competencies in the context of higher education. Wang et al. (2022) empirically tests whether universal and broadly applicable pedagogies like case studies, interdisciplinary team teaching, lecturing, mind and concept maps, project and/or problem- based learning can help to develop students' sustainability competencies. The results showed that the universal and broadly applicable pedagogies positively influence the development of students' sustainability competencies.

Noticeably, the above studies generally suggest didactic approaches for sustainability competencies in general and do not point out the clear link between them. In other words, the studies do not explicitly show how a certain sustainability competency is connected to its corresponding didactic approaches and vice versa. Among the limited attempts to connect two dimensions of ESD, pedagogical approaches and sustainability competencies, Lozano et al. (2017, 2019) were the first to employ a systematic approach to examine the link between the two dimensions. Specifically, Lozano et al. (2017, 2019) proposed and revised the connection between 12 pedagogical approaches and 12 sustainability competencies. The framework shows that each competency is connected to its corresponding pedagogical approaches. For example, project and/or problem-based learning has a high likelihood of addressing anticipatory thinking, critical thinking and collaboration. Meanwhile, lecturing may address critical thinking but cannot address any other sustainability competencies (Lozano et al., 2019). Lozano et al. (2017, 2019) identify three levels of connection between pedagogical approaches and competencies, i.e., likely, maybe, and unlikely.

Considering the current gaps in examining the link between competencies and pedagogical approaches, this study contributes to filling the void in the ESD literature by examining to what extent the pedagogical approaches at a TEI, Hanoi National University of Education (HNUE), can help to develop sustainability competencies.

3. MATERIALS AND METHODS

3.1. Materials

HNUE is one of the key TEIs in Vietnam. It has been offering a competency-based curriculum since 2020. Earlier studies have shown that ESD has been incorporated into the teacher training program by HNUE. More specifically, a wide range of SD themes were integrated in the curricula and some sustainability competencies recommended by UNESCO were incorporated in the learning outcomes (Nguyen et al., 2022; Nguyen, 2022, 2023). This study can be considered a follow-up study of the assessment by Nguyen et al. 2022. In the study by Nguyen et al. (2022), the authors reviewed the integration of ESD in teacher training programs in terms of learning content, learning outcomes and pedagogical approach, by analyzing 429 course syllabi offered by HNUE. In relation to the pedagogical approach, the results showed that in-class and out-of-class didactic approaches were identified in the course syllabi offered by 13 disciplines at HNUE, 421 and 17 respectively. The didactic approaches in this case are the recommended approaches by program developers or instructors when they designed the syllabi. Considering that out-of-class approaches were hardly used, this study only focuses on examining how 28 in-class didactic approaches utilized by HNUE lecturers in the training programs (Table 1) connect to sustainability competencies.

Table 1. In-class activities

	Didactic approach	Courses utilizing activities
Passive	Lectures	421 (98.1%)

	Q&A	110 (25.6 %)
	Group discussion	304 (70.9 %)
	Group/team work	301 (70.2 %)
	Problem solving	167 (38.9 %)
	Project-based learning	101 (23.5 %)
	Practice & feedback	93 (21.7 %)
	Seminar	82 (19.1 %)
	Using visual aids	53 (12.4 %)
	Case study	42 (9.8 %)
	1 minute paper	16 (3.7 %)
	Brainstorming	14 (3.3 %)
	Role play	12 (2.8 %)
	Microteaching	11 (2.6 %)
Active	Inquiry-based learning	10 (2.3 %)
	Mind map	5 (1.2 %)
	Jigsaw	5 (1.2 %)
	Games	5 (1.2 %)
	Learning cafe	5 (1.2 %)
	Discovery learning	4 (0.9 %)
	KWL	3 (0.7 %)
	WebQuest	2 (0.5 %)
	Experiential learning	2 (0.5 %)
	Gallery Walk	1 (0.2 %)
	Learning corners	1 (0.2 %)
	Drama	1 (0.2 %)
	Debate	1 (0.2 %)

(*Sources: Nguyen et al., 2022*)

3.2. Research methods

In this study, HNUE's 28 didactic approaches are evaluated on how they connect to eight sustainability competencies by UNESCO (2017) based on the relevant framework and literature. The eight sustainability competencies by UNESCO (2017) are used for the reason that this framework was used in a range of studies assessing the teacher training curriculum of HNUE from the perspective of ESD (Nguyen et al., 2022; Nguyen, 2022, 2023). Basically, the didactic approaches will be assigned the level of connection to the corresponding competencies according to the framework proposed by Lozano et al. (2019), namely "likely", "maybe", and "unlikely". If the didactic approaches cannot be found in the framework by Lozano et al. (2019) but are highlighted by the relevant literature (for example, Ceulemans & De Prins, 2010; Cotton & Winter, 2010; Gugerell & Zuidema, 2016; Lambrechts et al., 2013, etc.), then they will be assigned "maybe". Assigning the level of connection at the same time is performed based on a hermeneutics approach. The goal of the hermeneutics method is to analyze written materials through interpretation (Leyh, 1988). Analyzing understanding allows hermeneutical research to potentially create reliable interpretations (Lozano et al., 2015) and the analysis depends on the interpreter's experience (Dilthey & Jameson, 1972).

4. RESULTS AND DISCUSSION

Among 28 didactic approaches, only 13 approaches have well-cited references in the ESD literature to promote competencies (Figure 1).

	Courses utilizing approaches (Nguyen *et al.*, 2022)	System thinking competency	Anticipatory competency	Normative competency	Strategic competency	Collaboration competency	Critical thinking competency	Self-awareness competency	Integrated-problem solving competency
Lectures	421	white	white	yellow	white	white	yellow	white	white
Group discussion	304	yellow	yellow	yellow	yellow	yellow	yellow	yellow	yellow
Group/team work	301	yellow	yellow	yellow	yellow	green	yellow	yellow	yellow
Problem solving	167	yellow	green	yellow	yellow	yellow	green	green	green
Project-based learning	101	yellow	green	yellow	yellow	yellow	green	green	green
Case study	42	yellow	yellow	yellow	yellow	yellow	yellow	yellow	yellow
Brainstorming	14	yellow	yellow	yellow	yellow	yellow	yellow	yellow	green
Role play	12	yellow	yellow	yellow	yellow	green	yellow	green	yellow
Mind map	5	yellow	green	yellow	yellow	yellow	yellow	yellow	yellow
Jigsaw	5	yellow	yellow	yellow	yellow	yellow	yellow	green	yellow
Games/Gamification	5	yellow	yellow	yellow	yellow	yellow	yellow	yellow	yellow
Experiential learning	2	yellow	yellow	yellow	yellow	yellow	yellow	yellow	yellow
Debate	1	yellow	yellow	yellow	yellow	yellow	yellow	yellow	yellow

Figure 1. The connection between didactic approaches and sustainability competencies at HNUE

(Green cells = likely, yellow cells = maybe, white cells = unlikely)

The didactic approaches with the greatest likelihood to develop sustainability competencies include problem-solving and project-based learning (4 likely, 4 maybe). These approaches have been recommended quite often in the training programs by HNUE, in 167 and 101 courses respectively. Lectures, which were the most popular approach utilized in the courses, were the didactic approach with the least likelihood to promote competencies (2 maybe, 6 unlikely).

The competencies most likely to be promoted include self-awareness (4 likely, 8 maybe and 1 unlikely), anticipatory (3 likely, 9 maybe, 1 unlikely), and integrated problem solving (3 likely, 9 maybe, 1 unlikely). The competencies least likely to be promoted through the examined didactic approaches include system thinking and strategic (1 unlikely and 12 maybe). Some typical didactic approaches with the greatest likelihood to develop sustainability competencies (Lozano et al., 2019) were not captured in the courses of HNUE, eco-justice and community, interdisciplinary team learning, and community service learning, to name a few.

Noticeably, some didactic approaches that can promote sustainability competencies were hardly utilized: debate (1 course), experiential learning (2 courses), games, jigsaw, mind map (5 courses), role play (12 courses), brainstorming (14 courses).

Half of the didactic approaches in Table 1 were not known to be broadly used in promoting sustainability competencies, specifically, Q&A, Practice & feedback, Seminar, Using visual aids, 1-minute paper, Microteaching, Inquiry-based learning, Discovery learning, Learning cafe, KWL, WebQuest, Gallery Walk, Learning corners, Drama. However, this does not mean that utilizing these didactic approaches cannot help promote sustainability competencies at HNUE. Indeed, discovery learning and inquiry-based learning are considered constructivist approaches in teaching and learning which have been highly recommended in teaching ESD in some studies (Armstrong, 2011; Leder, 2017; Nguyen et al., 2021). Q&A also can be used to develop students' competencies if the lecturers/instructors can find a way to turn or relate this approach to a Socratic method (Stough et al., 2018). In practice, instructors usually fail to recognize questioning as a skill and elaborate this skill in a vague and purposeless way resulting in wasting time and failing to elicit useful information (Neenan, 2008). Using visual aids can help to promote sustainability competencies if it is about watching a video or looking at photos, or other visual aids to initiate reflection or discussion (Cotton & Winter, 2010). In general, some didactic approaches can have relevance in teaching sustainability; however, they have not been widely recognized approaches in higher education that specifically address sustainability competencies. Therefore, it is vital to have empirical studies examining the

possibilities of these didactic approaches in promoting sustainability competencies and in different contexts, for example, non-Western contexts and under-resourced settings.

It is worth noting that the typical didactic approaches with the greatest likelihood to promote sustainability such as eco-justice and community, inter-disciplinary team learning, community service learning (Lozano et al., 2019) were absent in the curricula by HNUE. This may refrain students from being exposed to learning opportunities that help develop sustainability competencies the most. This study, thus, encourages instructors in higher education in general and in TEIs in particular to explore alternative approaches to traditional lectures to convey sustainability, allow learners to develop different learning processes, and develop competencies. Specifically, it calls for teacher educators to explore the optimal didactic approaches to enable students to critically examine their conceptions of sustainability and their existing beliefs, to change their lifestyles and take actions toward sustainability.

Also, it is noteworthy that this study only focuses on examining prescribed didactic approaches by instructors in the training programs. This study has not captured how instructors or teacher educators use didactic approaches in their classroom and therefore has not measured how the pedagogies highlighted by instructors actually impact students' competencies development. The limitations require further research to continue to advance sustainability in teacher education and higher education.

5. CONCLUSION

This study investigates how the didactic approaches at HNUE connect to sustainability competencies. Almost half of the examined didactic approaches have well-cited references in the literature to promote sustainability competencies, only a small number of which have the great likelihood to develop sustainability competencies. Many typical didactic approaches with the strong likelihood to promote sustainability were absent in the teacher training syllabi by HNUE. It appears that the current recommended didactic approaches at HNUE contribute not much to developing sustainability competencies. Nevertheless, it still has been insufficient to make a definitive statement about the state of connection between the didactic approaches and sustainability competencies since half of the approaches were not known to be broadly used in promoting sustainability competencies. While considering the importance of teacher education in advancing ESD, this result calls for better and systematical incorporation of ESD principles in teacher education programs. This should be addressed in curriculum development, specifically, curriculum designers should be aware of the dimensions of ESD, learning content, learning outcomes (competencies), and pedagogy (didactic approaches).

This study contributes to advancing the understanding of the relationship between didactic approaches and sustainability competencies, which has remained poorly researched. However, there are still some constraints. First, only half didactic approaches in the data can be connected to their corresponding competencies; this study has not clarified the possibility of the other approaches in promoting sustainability competencies. Therefore, further research can move forward to explore systematically to which extent the employed didactic approaches by HNUE can promote sustainability competencies. Similar studies also can be performed in different TEIs to provide a broader understanding of the contribution of teacher education in addressing sustainability. Next, the analysis in this study is framed based on Western-derived literature and framework. This can partly lead to the failed coverage of didactic approaches with the greatest likelihood to develop sustainability competencies among 28 didactic approaches by HNUE. Hence, further studies should focus on a systematic framework connecting didactic approaches and sustainability competencies (in non-Western contexts) which has been empirically measured.

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REFERENCES

Albareda-Tiana, S., Vidal-Raméntol, S., & Fernández-Morilla, M. (2018). Implementing the sustainable development goals at university level. *International Journal of Sustainability in Higher Education*, *19*(3), 473-497. https://doi.org/10.1108/IJSHE-05-2017-0069

Annelin, A. (2021). *Professional studies sustainability competencies and experiential learning in higher education: student perceptions*. University of Gothenburg.

Armstrong, C. M. (2011). Implementing Education for Sustainable Development: The Potential use of Time-Honored Pedagogical Practice from the Progressive Era of Education. *Journal of Sustainability Education*, *2*. http://www.jsedimensions.org/wordpress/wp-content/uploads/2011/03/Armstrong2011.pdf

Barth, M., & Rieckmann, M. (2012). Academic staff development as a catalyst for curriculum change towards education for sustainable development: An output perspective. *Journal of Cleaner Production*, *26*, 28-36. https://doi.org/10.1016/j.jclepro.2011.12.011

Brundiers, K., Barth, M., Cebrián, G., Cohen, M., Diaz, L., Doucette-Remington, S., Dripps, W., Habron, G., Harré, N., Jarchow, M., Losch, K., Michel, J., Mochizuki, Y., Rieckmann, M., Parnell, R., Walker, P., & Zint, M. (2021). Key competencies in sustainability in higher education - toward an agreed-upon reference framework. *Sustainability Science*, *16*(1), 13-29. https://doi.org/10.1007/s11625-020-00838-2

Ceulemans, K., & De Prins, M. (2010). Teacher's manual and method for SD integration in curricula. *Journal of Cleaner Production*, *18*(7), 645-651. https://doi.org/10.1016/j.jclepro.2009.09.014

Cotton, D., & Winter, J. (2010). 'It's not just bits of paper and light bulbs': A review of sustainability pedagogies and their potential for use in higher education. In P. Jones, D. Selby, & S. Sterling (Eds.), *Sustainability Education: Perspectives and Practice across Higher Education*. Earthscan.

de Haan, G. (2010). The development of ESD-related competencies in supportive institutional frameworks. *International Review of Education*, *56*(2), 315-328. https://doi.org/10.1007/s11159-010-9157-9

Dilthey, W., & Jameson, F. (1972). The Rise of Hermeneutics. *New Literary History*, *3*(2), 229-244. https://doi.org/10.2307/468313

Figueiró, P. S., & Raufflet, E. (2015). Sustainability in higher education: A systematic review with focus on management education. *Journal of Cleaner Production*, *106*, 22-33. https://doi.org/10.1016/j.jclepro.2015.04.118

Fortuin, I. K. P. J., & Bush, S. R. (2010). Educating students to cross boundaries between disciplines and cultures and between theory and practice. *International Journal of Sustainability in Higher Education*, *11*(1), 19-35. https://doi.org/10.1108/14676371011010020

Gordon, S., & Thomas, I. (2018). 'The learning sticks': Reflections on a case study of role-playing for sustainability. *Environmental Education Research*, *24*(2), 172-190. https://doi.org/10.1080/13504622.2016.1190959

Gugerell, K., & Zuidema, C. (2016). Gaming for the energy transition. Experimenting and learning in co-designing a serious game prototype. *Journal of Cleaner Production*, *169*, 105-116.

Hopkinson, P., & James, P. (2010). Practical pedagogy for embedding ESD in science, technology, engineering and mathematics curricula. *International Journal of Sustainability in Higher Education*, *11*(4), 365-379. https://doi.org/10.1108/14676371011077586

Krah, J. M., Reimann, J., & Molitor, H. (2021). Sustainability in brandenburg study programs. perspectives for anchoring sustainability in higher education curricula. *Sustainability (Switzerland)*, *13*(7). https://doi.org/10.3390/su13073958

Lambrechts, W., Mulà, I., Ceulemans, K., Molderez, I., & Gaeremynck, V. (2013). The integration of competences for sustainable development in higher education: An analysis of bachelor programs in management. *Journal of Cleaner Production*, *48*, 65-73. https://doi.org/10.1016/j.jclepro.2011.12.034

Leder, S. (2017). *Transformative Pedagogic Practice. Education for Sustainable Development on Water Conflicts in Geography Education in India*. Springer.

Leyh, G. (1988). Toward a Constitutional Hermeneutics. *American Journal of Political Science*, *32*(2), 369-387. https://doi.org/10.2307/2111128

Lovren, O., Maruna, V. M., & Stanarevic, S. (2020). Reflections on the Learning Objectives for Sustainable Development in the Higher Education Curricula - Three Cases from the University of Belgrade. *International Journal of Sustainability in Higher Education*, *21*(2), 315-335.

Lovren, V. O. (2019). Didactic Re-orientation and Sustainable Development. In W. Leal Filho (Ed.), *Encyclopedia of Sustainability in Higher Education*. Springer.

Lozano, R., & Peattie, K. (2011). Assessing Cardiff University's curricula contribution to sustainable development using the STAUNCH (RTM) system. *Journal of Education for Sustainable Development*, *5*(1), 115-128.

Lozano, R., & Young, W. (2013). Assessing sustainability in university curricula: Exploring the influence of student numbers and course credits. *Journal of Cleaner Production*, *49*, 134-141. https://doi.org/10.1016/j.jclepro.2012.07.032

Lozano, R., Barreiro-Gen, M., Lozano, F. J., & Sammalisto, K. (n.d.). Teaching Sustainability in European Higher Education Institutions: Assessing the Connections between Competences and Pedagogical Approaches. *Sustainability*, *11*(6), 1602. https://doi.org/10.3390/su11061602

Lozano, R., Carpenter, A., & Huisingh, D. (2015). A review of 'theories of the firm' and their contributions to Corporate Sustainability. *Journal of Cleaner Production*, *106*, 430-442. https://doi.org/10.1016/j.jclepro.2014.05.007

Lozano, R., Merrill, M. Y., Sammalisto, K., Ceulemans, K., & Lozano, F. J. (2017a). Connecting competences and pedagogical approaches for sustainable development in higher education: A literature review and framework proposal. *Sustainability (Switzerland)*, *9*(10), 1-15. https://doi.org/10.3390/su9101889

Martens, P., Roorda, N., & Cörvers, R. (2010). Sustainability, Science, and Higher Education - The Need for New Paradigms. *Sustainability*, *3*(5), 294-303. https://doi.org/10.1089/SUS.2010.9744

McKeown, R., Hopkins, C. A., Rizi, R., & Chrystalbridge, M. (2002). *Education for sustainable development toolkit*. http://dblog.gre.ac.uk/greengreenwich/files/2015/03/ESD-toolkit-_-University-of-Tennessee.pdf

Mezirow, J. (2000). *Learning as transformation: critical perspectives on a theory in progress*. Jossey-Bass.

Mogensen, F., & Schnack, K. (2010). The action competence approach and the 'new' discourses of education for sustainable development, competence and quality criteria. *Environmental Education Research*, *16*(1), 59-74. https://doi.org/10.1080/13504620903504032

Neenan, M. (2008). Using Socratic questioning in coaching. *Journal of Rational-Emotive & Cognitive-Behavior Therapy*, *27*(4), 249-264.

Nguyen, A. N., Nguyen, T. P., Kieu, K. T., Nguyen, Y. T. H., Dang, D. T., Singer, J., Schruefer, G., Tran, T. B., & Lambrechts, W. (2022). Assessing teacher training programs for the prevalence of sustainability in learning outcomes, learning content and didactic approaches. *Journal of Cleaner Production*, *365*, 132786. https://doi.org/10.1016/j.jclepro.2022.132786

Nguyen, P. T. (2019). *Education for Sustainable Development in Geography Teaching in Vietnam: Investigating ESD Interpretation, Integration and Implementation*. University of Muenster.

Nguyen, P. T. (2022). Tích hợp các nội dung phát triển bền vững trong chương trình đào tạo giáo viên: Nghiên cứu tại ba cơ sở đào tạo giáo viên của Việt Nam [The integration of sustainability contents in teacher education programs: A case study in three teacher education institutions in Vietnam]. *Tạp chí Giáo dục*, *22*(21), 1-8.

Nguyen, P. T. (2023). Định hướng phát triển năng lực trong chương trình đào tạo giáo viên: Góc nhìn từ quan điểm Giáo dục Phát triển bền vững [Orientation for capacity development in teacher training programs: Perspective from the perspective of sustainable development education]. *Tạp chí Giáo dục*, *23*(14), 40-46.

Nguyen, P. T., Leder, S., & Schruefer, G. (2021). Recontextualising Education for Sustainable Development in pedagogic practice in Vietnam: linking Bernsteinian and constructivist perspectives. *Environmental Education Research*, *27*(3), 313-337. https://doi.org/10.1080/13504622.2021.1879732

Posch, A., & Steiner, G. (2006). Integrating research and teaching on innovation for sustainable development. *International Journal of Sustainability in Higher Education*, *7*(3), 276-292. https://doi.org/10.1108/14676370610677847

Rieckmann, M. (2012). Future-oriented higher education: Which key competencies should be fostered through university teaching and learning? *Futures*, *44*(2), 127-135. https://doi.org/10.1016/j.futures.2011.09.005

Rieckmann, M. (2018). Learning to transform the world: key competencies in Education for Sustainable Development. In A. Leicht, J. Heiss, & W. J. Byun (Eds.), *Issues and trends in education for sustainable development - UNESCO Digital Library* (pp. 39-60). UNESCO Publishing. https://unesdoc.unesco.org/ark:/48223/pf0000261445

Sahakian, M., & Seyfang, G. (2018). A sustainable consumption teaching review: From building competencies to transformative learning. *Journal of Cleaner Production*, *198*. https://doi.org/10.1016/j.jclepro.2018.06.238

Sprain, L., & Timpson, W. M. (2012). Pedagogy for sustainability science: Case-based approaches for interdisciplinary instruction. *Environmental Communication*, *6*(4), 532-550. https://doi.org/10.1080/17524032.2012.714394

Stough, T., Ceulemans, K., Lambrechts, W., & Cappuyns, V. (2018). Assessing sustainability in higher education curricula: A critical reflection on validity issues. *Journal of Cleaner Production*, *172*, 4456-4466. https://doi.org/10.1016/j.jclepro.2017.02.017

UNESCO. (2005). *Guidelines and recommendations for reorienting teacher education to address sustainability*. https://unesdoc.unesco.org/ark:/48223/pf0000143370

UNESCO. (2017). *Education for Sustainable Development Goals. Learning Objectives*.

Wang, Y., Sommier, M., & Vasques, A. (2022). Sustainability education at higher education institutions: pedagogies and students' competences. *International Journal of Sustainability in Higher Education*, *23*(8), 174-193. https://doi.org/10.1108/IJSHE-11-2021-0465

Wiek, A., Bernstein, M., Foley, R., Cohen, M., Forrest, N., Kuzdas, C., Kay, B., & Withycombe, K. L. (2016). Operationalising competencies in higher education for sustainable development. In M. Barth, G. Michelsen, M. Rieckmann, & I. Thomas (Eds.), *Handbook of higher education for sustainable development* (pp. 241-260). Routledge.

Wiek, A., Withycombe, L., & Redman, C. L. (2011). Key competencies in sustainability: A reference framework for academic program development. *Sustainability Science*, *6*(2), 203-218. https://doi.org/10.1007/s11625-011-0132-6