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Training Future Kindergarten Teachers on Ecocentric Action

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Abstract

As education is a powerful means of promoting sustainability, it is necessary to think and act on the (trans)formation of the professional profile of the future kindergarten teacher. As ecocentric educational practices can be a crucial point, ecocentric action competence needs to be developed. In this context, pedagogical traineeship supervisors can play a meaningful role. Accordingly, this study analyzed the didactic-pedagogical potential of a training strategy in science teaching based on reflection-critical thinking about what effective science teaching is. Further, it investigated the mediating role of action research methodology in promoting trainee reflexivity. The findings highlighted the merits of the formative perspective adopted, given the learning evidenced by children and stated in the traineeship report. It is concluded that the role of the supervisor is relevant in the construction of a pedagogical outlook of science teaching aligned with environmental values. It is time to take the traineeship process as a space to understand and identify pathways for empowering ecocentric action.

Keywords: Ecocentric action, pedagogical traineeship, preschool education, science teaching, traineeship supervisor.

Introduction

The importance of and need for ecocentric education intensify with increased environmental problems. Without the ecocentric values, there is no future for the planet; “the world is unsustainable, and the lack of sustainability is caused by attitude” (Salīte, Fjodorova, Butlere et al., 2021, p. 161), “but lasting change is impossible without education” (UNESCO, 2021); “we need to change the way we learn and educate” (UNESCO, 2008). It is important to bring research in science didactics to the field of

pedagogical internship, stimulating the intern to the innovation of pedagogical practices in line with the need for answers to the local and global environmental realities / problems of nature, making them researchers of ecocentric education. Higher education institutions with statutory attributions in the education field will certainly play an important role as regards training future educators and teachers qualified to develop ecocentric attitude and values.

In (re)building the meaning of science teaching focused on Education for Sustainable Development (ESD), professional didactics can be the central axis of this process. Under the pedagogical internship of the initial kindergarten teacher training, we have been following this perspective to develop pedagogical skills for the promotion of children's ecocentric education.

This study was carried out as part of science teaching internship in preschool education. The training benchmark for developing ecocentric action was enhancing the profile of kindergarten teacher-researcher in the research-action context (Cohen et al., 2000). The theoretical frame of reference in which we situate ourselves to reflect on the process of knowledge construction (children's learning) falls within the socio-constructivist paradigm (Hodson, 1998).

Literature Review

There are real educational challenges in relation to environmental problems. There is the need for the development of a perception of biological kinship between the human and nature (Salīte, Fjodorova & Ivanova, 2021). According to Kyle (2020), science education is not being developed as a way to face and help overcome the serious issues that humanity faces. As it is underlined by Salīte, Fjodorova, and Ivanova (2021), the development of critical thinking skills "about the world we live in, who we are and how we treat the world by acting and living in it" is a key that deepens the development of knowledge on the complex phenomenon of sustainability and its relation to sustainable development and education. The protection of nature begins in childhood (Chawla, 2020).

Preschool education is the first stage of basic education in the lifelong education process (DGE, 2016), so the best teaching methods for achieving ecocentrism aims need to be used. Children have a natural desire to know and understand why. Children must understand their role in nature. Ecocentric education should therefore be seen as an important purpose of science teaching in preschool. Ultimately, schools of education responsible for training future kindergarten teachers can play a key role in this endeavor. Pedagogical internship in the curriculum of the course in preschool education may assume special importance in the construction of the profile of professionals with an intervening role in the development of ecocentric scientific literacy (Ferreira et al., 2019). In this process of (re)construction of the professional profile, the supervisory professor of the pedagogical internship can be the mediator of change. Development is assumed to be of an investigative, critical, and reflective attitude that contributes to the formation of professional identity, (re)signifying it and (re)constructing it continuously in the design of ESD, that is, a training oriented towards pro-activity concerning environmental problems. According to UNESCO (2018), ESD enables students to make informed decisions and responsible actions towards environmental integrity. A better and more sustainable future must be shaped through education and learning (UNESCO, 2019, 2021a). The ESD seeks to educate for active citizenship (Chen & Liu, 2020; Cheeseman et al., 2019). ESD advocates transformational

education to meet the challenges of sustainability. ESD is at the heart of the 2030 Sustainable Development Agenda and is recognized as a key element of sustainable development. ESD must promote "learning to know, learning to do, learning to be, learning to live together, learning to transform oneself, and society" (UNESCO, 2008, p. 8).

Several studies address the relationships between the pre-service training of teachers and pupils' results. Researchers have observed the unclear link between teacher training and quality (Rivkin et al., 2005; O'Sullivan, 2006; Perrenoud et al., 2008; Akyeampong et al., 2013). These findings do lead to the conclusion of the need to rethink and explore the initial teacher teaching and compel scholars to keep in mind this phenomenon in the preschool education context (Ghorbani et al., 2018).

Revisiting the theory of transformative learning (Clark, 1993), the perspectives of learners build on the following dimensions: psychological, "convictional" and behavioral. In the context of ESD, the behavioral dimension is crucial and takes on special importance in the interrelationships with nature. The educator must enable children "to change their views of the world and to be critical, reflective, and interventional" (Ferreira & Pitarma, 2021, p.142), developing "a perspective in which sustainability is present in every human activity or experience" (Salīte, Fjodorova & Ivanova, 2021, p. 3). It is necessary to develop "sustainability citizens" (Wals, 2015; Wals & Lenglet, 2016), that is, children capable of contributing to the necessary transformation of the environment in which they live (Robinson & Vaealiki, 2018, Chawla & Cushing, 2007). Anthropocene problems require pedagogical responses from education (Salīte, Fjodorova & Ivanova, 2021). Ecocentric education is "nature-centered", that is, the human being is a being who belongs to nature, values it and is involved in solutions to environmental problems (Salīte et al., 2020). However, this objective of education is largely conditioned by the pedagogical training processes of these professionals. Salīte (1998) underlines the importance of the teachers in the "implementation of an ecocentric paradigm". It is essential to (re)think the training paths, namely, the didactic-pedagogical logic of pedagogical training. Salīte et al. (2020, 2021, 2022) conclude that implementation of the Sustainable Development Goals needs the endeavor of reorientation of education, sound educational research in which to see sustainability issues more broadly and to explore the multiplicity of manifestations of this phenomenon in real relationships and education. Undoubtedly, the incorporation of ESD into teacher education needs further research.

"The teaching and learning process needs to be significant for both the teacher and the learner" (UNESCO, 2018, p. 137). "The ultimate goal of teacher training should be to prepare sustainably literate teachers to achieve the transformative goals and objectives of ESD" (UNESCO, 2018, p.155). It is argued that the training process of future kindergarten teachers, in the context of pedagogical internship, must be (re)oriented to enable (have the will and be able) them for pro-environmental action, that is, to develop the ecocentric action (Jensen & Schnack 2006/1997); Fontes, 2004; Piasentin & Roberts, 2018). Science teaching should favor the development of ecocentric education (Ferreira et al., 2019; Ferreira & Pitarma, 2021). The research shows that pedagogical supervision, based on the reinforcement of reflective capacity, can be an important strategy for building professional knowledge and teaching quality (Azevedo, 2012), making the trainee student a critical researcher. It is of high importance to (re)target teacher education because the teaching practices are the key. These are great challenges, but as Salīte et al. (2022) points out, "When Our Will is Big, the Obstacles

are Small!". Therefore, there is a need to reflect on the role of higher education in future kindergarten teacher training in science teaching on ecocentric action.

Pedagogical and Didactic Experiment

Research Question and Objectives

The study on a future kindergarten teacher's pedagogical training was guided by the following research question:

What are the training pathways to follow in order to develop ecocentric action competence?

The following objectives were set: (1) to analyze the effectiveness of a training strategy in science teaching based on critical reflection about what effective science teaching is; (2) to analyze the effectiveness of a pedagogical-didactic sequence in science teaching through children's ecocentric learning.

Context of Action

As part of the teaching internship for the Master's degree in preschool education, a pedagogical and didactic experiment was developed. The supervised internship was carried out in a public kindergarten that belongs to our university's cooperation network, complying with the ethical standards established in the cooperation protocol.

Methodology

The conception and operationalization of the developed pedagogical-didactic sequence, as well as the interactive-reflective pedagogical supervision, were anchored in the action research methodology (ARM). This methodology puts the researcher and the participants on the same plane of action, and it is governed by the need to solve real problems, thus allowing for immediate application in the context (Cohen et al., 2000; Bogdan & Biklen, 2010; Bing-You et al., 2015; Engel, 2000; Esteves, 2008; Alves, 2020; González-Weil et al., 2021).

Participants

The study involved: the traineeship supervisor; the trainee (student of the professional Master's degree in preschool education); a group of twelve children (three years old, five females and seven males) from a kindergarten of the public preschool education network.

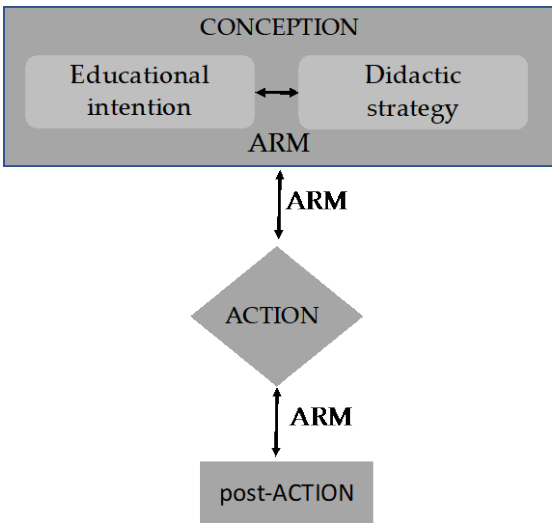
Data Collection

The main data collection techniques were direct and participatory observation (Bogdan & Biklen, 2010), analysis of the children's records and analysis of the traineeship report (the report is drawn up from the experiences in the internship context).

Training Pathway and Design of Pedagogical Approach

The training pathway comprised, sequentially, three stages (Figure 1): (1) Conception of the didactic sequence; (2) Action; (3) Post-action.

Figure 1
Training Pathway



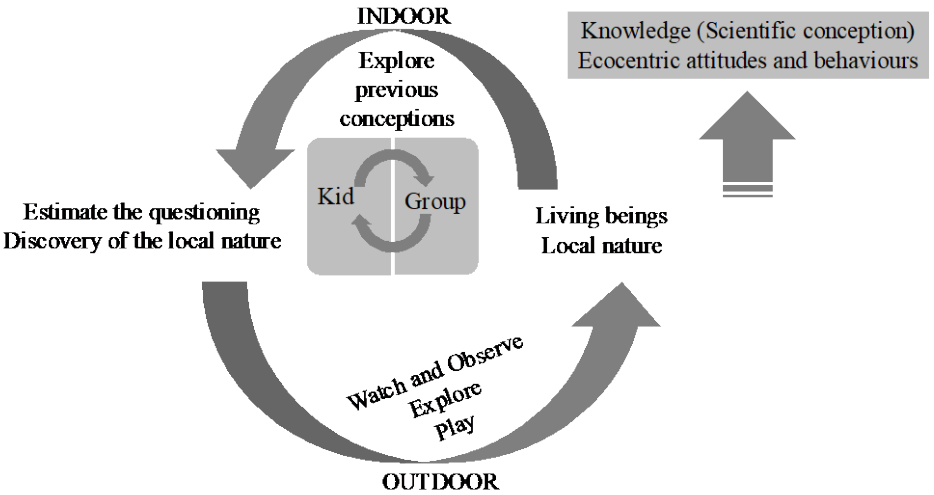
Stage 1: Design of the didactic sequence

We start by reflecting on: "What effective science teaching means?"

It was concluded that the teacher should have the ability "to look" at the real problems, to develop action research and reflection habits to find the best didactic strategies and resources to promote ecocentric education – educate for a sustainable world.

After several reflection sessions (trainee and supervisor) with problematizing questions about the construction of knowledge in preschool children and the development of ecocentric attitudes and values, it was concluded that the science teaching should have a holistic dimension substantiated by values of solidarity, responsibility, and building positive attitudes towards problems of the surrounding reality, namely environmental ones. Thus, developing scientific literacy in children should enable children's involvement/connection to environmental problems and seeking a solution, with the process of teaching and learning being a key point. At this moment, we made arrangements that constant monitoring of cognitive and social-emotional development would be carried out in the paradigm of connectedness of scientific conceptual learning to ecocentric attitudinal learning. Thus, the concept of preserving nature (ecocentric education) will be embodied in the orientation of the nurture critical importance for all living beings and not because it is important only for the well-being of humans. This way discovering local nature will promote the children's connection with nature. Accordingly, the city's natural park was chosen for this educational purpose. The intended educational intention was established through a conceptual scheme (Figure 2).

Figure 2
Conceptual Scheme of the Pedagogical-Didactic Sequence



This was followed by the choice of the theme, which was framed in the content area of "World Knowledge" of the "Curriculum Guidelines for Preschool Education" (DGE, 2016). The learning goals were established and the didactic strategies were chosen (Table 1), where there should be flexibility in teaching methods.

Table 1
Planning the Pedagogical-Didactic Sequence

Theme	*Contents*	*Learnings to promote*	*Teaching strategy* (Research-action context)
Fauna and Flora	Living beings in the local nature*: - Discovering animals and plants. - Your preservation. * Natural Park (on the banks of the river) in the city where the kindergarten is located.	-Understand and identify characteristics of living beings. - Recognise the relevance of a river without pollution for living beings. -Understand oral ecocentric messages in different communication situations. -Demonstrate awareness of the consequences of human actions in nature. -Valuing the need for preservation from the natural environment.	- Listen to children. - Encourage children to listen and question. - Constant dialogic interaction. - Articulate the indoor context with the outdoor one. - Explore the following educational resources: storybook, movie, puppet, and games. - Build didactic guides to use when consolidating/ assessing learning.

The established methodological principle was of three sequential moments for the development of activities (sessions): start by involving each child with the object of knowledge in an articulated perspective/continuum between sessions; (re)build knowledge; consolidate/evaluate learning. Indoor sessions should not last longer than 30 minutes, as these children are in the preoperative development phase (Piaget, 1970). It was decided to give priority (longer duration of the session) to the outdoor context (close natural environment). The lack of regular contact with nature can explain the fear, discomfort, and aversion to the environment (Gill, 2014). Learning in an outdoor context provides "interactions between emotions, actions, and thoughts, based on practical observation in authentic situations" (Gustafsson et al., 2011, p. 7). Playfulness plays an important role in the child's development (Vygotsky, 1994), the educational game can be a learning facilitator (Farias & Cândido, 2019; Carbo et al., 2019), and playful activities develop memorization, reasoning, and reflection, promoting the (re)construction of knowledge (Santana & Rezende, 2007), and "ESD pedagogies often draw upon the arts using drama, play, music, design and drawing to stimulate creativity and imagine alternative futures" (UNESCO, 2012, p. 1). Therefore, in all sessions, it was decided to introduce a supervised didactic game. The game would be used for consolidating learning and evaluating targeted learning. We chose games that were very familiar to these children. The intern would assume the role of advisor and observer.

It was established that the didactic sequence (Table 2) would be materialized in sequential activities in two contexts (indoor and outdoor), to be developed weekly, and for 5 weeks. All teaching resources were developed.

Table 2

Perspective of the Implementation Sequence, Operational Descriptors, and Teaching Resources

Sequence of sessions	***Operative descriptors***	***Didactic resources***
1st session Duration: 30 min; in the activities room (indoors). Goals: To get to know the children's previous concepttions about: - the living beings of the river; - river pollution; - river pollutants; - the concept of a polluted river. To raise awareness of the relevance of our environmental preservation practices. To motivate to care for/protect nature.	1st: Read the story "Iara and Water Pollution" (Branco, 2002) about water pollution. Dialogue on the story's message, stimulating the affective feeling of protection concerning the river and living beings in the river, as well as the need for all of us to change practices (the garbage we produce). Understand the relationship bet-ween human practices and river pollution. 2nd: Game of Differences: Explore images of polluted rivers and rivers without traces of pollution (identify and justify (explain why). Identify which image corresponds to the polluted river; identify the pollutants present in the images. 3rd: Record in the didactic script (DS1) the conceptions about polluted rivers and pollutants.	Construction of a didactic script (DS1) to record the conceptions of what a polluted river is. Story: "Iara e a poluição da água" ("Iara and 'Water Pollution"). Educational game.

See next page for continuation of table

Continuation of Table 2

Sequence of sessions	***Operative descriptors***	***Didactic resources***
2nd session Duration: 30 min; in the activities room (indoors) Goals: - To recognize the ecopoints, typology and their functions; - To know the purpose of recycling.	1st: Story retelling from session 1; Dialogue and questioning about the places where the garbage/waste (pollutants) can be placed, visualized in history. 2nd: Watch a movie with a song about ecopoints. Interactive dialogue on the typology and function of ecopoints. 3rd: Realization of a game about the separation of waste/garbage. Children identify and separate/place waste in the respective recycling bin. 4th: Record in the didactic script (DS2) the conceptions about the colors of domestic ecopoints.	Construction of a didactic script (DS2) to register the conceptions about the colors of domestic ecopoints. A film about ecopoints ("Vamos lá reciclar -GOMBY" ("Let's Go Recycle – GOMBBY). Educational game: "Identification and Separation of Waste".
3rd session Duration: 30 min; in the activities room (indoors). Goals: - To discover the plants and animals in the city's Natural Park River.	1st: Through the dialogue, using a hand puppet and illustrated cardboard, some of the most abundant specimens of the fauna and flora of the river and its banks are presented. 2nd: Realization of the memory game on the previously presented specimens. 3rd: Record in the didactic script (DS3) learning about the animals and plants of local rivers referred to during the session.	Construction of the didactic script (DS3) for recording learning about the park's animals and plants. Hand puppet. Illustrated cardboard (70 cm x 70 cm) with some of the most abundant specimens of the fauna and flora. Educational game: "Memory Game".
4th session Duration: one morning; in the city's natural park (outdoors). Goals: - To observe and contact with the fauna and flora present in the natural environment (as in the city's natural park). - To observe if there is the preservation of the natural park.	1st: Observation of fauna, flora, and signs of pollution along the walk through the city's natural park. 2nd: Picnic followed by games: "Silence and Concentration Game", "Waste Identification and Separation Game" and "Pair Game". 3rd: Free exploration – the moment of playing and interacting freely.	Didactic games: "Silence and Concentration Game"; "Waste Identification and Separation Game"; "Pair Game".

See next page for continuation of table

Continuation of Table 2

Sequence of sessions	***Operative descriptors***	***Didactic resources***
5th session Duration: 30 min; in the activities room (indoors) Goals: To consolidate learning about: - the living beings of the river; - river pollution; - river pollutants; - the concept of a polluted river. To raise awareness of the relevance of our environ-mental preservation practices. To motivate to care for/protect nature.	1st: Dialogue on learning in the city's natural park. 2nd: Visualization of a video about water pollution – "The Beautiful River", by Elisabete Trigo & Santoli, lasting 3 minutes. 3rd: Dialogical interaction about what they learned in the film. 4th: Delivery of "Friend of the Environment" medals. 5th: Record of learning in the didactic script (DS4): Identification of a polluted river; association of different objects to the correct ecopoints; signs, with an X, of the animals and plants observed in the city's natural park.	Construction of a didactic script (DS4) about learning about: river pollution, waste/garbage placed in recycling bins and preservation of living beings (animals and plants) in nature. Movie – "O Belo Riozinho" (The Beautiful River), by Elisabete Trigo & Santoli, with a duration of 3 minutes.

At the end of each registration guide, the child evaluated the activity. The children evaluated the activity, marking in the didactic script of each session, the emoji corresponding to "liked" (happy droplet) or "did not like it" (sad droplet) (see Figure 3).

Observation grids (concerning knowledge and attitudes) were structured for the sessions. Regarding the dimension of knowledge, the following parameters were considered: Know; List; Describe; Understand; Recognize. With regard to the dimension of attitudes, the following were highlighted: Interest; Responsibility; Conscience; Involvement; Discouragement; Happiness.

Stage 2: Action

Development of the teaching-learning process foresaw the didactic sequence. It took place, in the first phase, in the activities room of the kindergarten (see Table 2), followed by the activity in the city's natural park and the last activity in the activities room.

Stage 3: Post-action

After each session (see Table 2), the trainee and supervisor professor reviewed the difficulties/obstacles in the teaching-learning process, discussed/reflected/ searched and decided on the need to adapt the pedagogical-didactic methods and resources. Aspects related to the interactive questioning in the exploration of teaching resources were occasionally refined.

After each session (see Table 2), the observations (of the children's learning) and difficulties registered by the intern were analyzed. After each session, records of DSs were analyzed to detect difficulties/obstacles in learning.

Results and Discussion

The analysis of the data collected was developed using the following categories: (i) children's learning and (ii) traineeship report.

(i) Children's Learning

The effectiveness of the didactic strategy followed in each session of the didactic-pedagogical sequence was observed and, at the end, some concluding remarks were made.

1st Session

The didactic sequence (1st session, Table 2) began with the children seated on the floor and arranged in a U-shape. The challenge of discovering "Iara and Water Pollution" [33] was posed. The main message of the story is "Don't pollute the rivers, because there live beings that will eventually die". The intern read the story. It was observed that the group was always very attentive to listening to the story. Some of the questions that the intern previously prepared and asked the group to understand the children's perspective/ideas about the story they had just heard: "Why was Iara sad?"; "Why were the fish sick?"; "Was the river water clean?"; "Why didn't the river water smell good?"; "Should wheels and plastic bottles be placed in the river?"; "Why was the river water so dark?". In this moment of guided conversation, in which the child was free to express what he had learned from the story, we observed that children always associated "dirty" with being polluted. It was also found that the children knew about polluting objects, based on the story they had just heard and on their memories of their daily lives. This finding is supported by Vygotsky's (1989) framework. Relevance given to the perspectives and participation of children in pedagogical practices (Correia et al., 2019) was substantiated in the pedagogical logic of critical questioning.

Then, the children faced the following challenge: "Which of the two images corresponded to a polluted river?" The option for the "Game of Differences" made it possible to verify whether the terms "pollution" and "pollution to river water" were effectively associated with the scientific concept. The children make correct association of images. They identified a polluted river as the "dirty river" because "there is garbage: plastics, bottles, cans …". At this point, the intern tried to find out, through conversation, if the children associated human practices as being responsible for the polluted river. It was observed that the children revealed an analogy about the consequences of the "polluted river" concerning living beings existing there. At this time, efforts were made to promote ecocentric education. It appeared that the statement "poor little fish" revealed affection/concern. The association of the consequences of the "polluted river" for humans was not explored because the children did not have the power of abstraction and we had no guarantee that instead of an ecocentric attitude an anthropocentric attitude would develop.

It should be noted that the strategy of preparing some of the questions to be asked in the constant interactive dialogue, as well as listening to the child about the exploration of images (game of differences) instigated moments of the effective approach of concern towards living beings living in polluted water. During this game, it was observed that the teaching process provided the development of oral expression, content, and environmental awareness (ecocentric education).

We concluded that this group, after this session, identified the polluted river and explained why it was polluted. In DS1 records carried out at the end of the activity, it appeared that the whole group enjoyed the activity – the "happy droplet" was used to rate the activity. The records (conceptions) in DS1 about what a polluted river is can be divided into two categories: Category X – heap of symbolic objects of garbage; Category Y – heap of symbolic garbage objects within two lines (river conception-existence of margins). The category X represents 75 % of records. One of these records is exemplified as well as the explanation given for the records (Figure 3 – Record I). The category Y represents 25 % of registrations. An example is one of these records (Figure 3 – Record II). Both marked the "happy droplet", meaning they enjoyed doing the activity.

Figure 3

Records of Two Children in DS1.

Record I: This child attributes the brown color to the river polluted with polluting objects, noting that he identified (painting) the plastic bottles with blue.

Record II: This child identifies the two blue lines as the river; the dry pink color corresponds to the polluted river and the black, blue, and wine-red colors correspond to polluting objects (wheels, plastic bottles, among others). Both children enjoyed the activity.



Record I Record II

In the evaluation carried out in the 1st session, the relevance of care in preparing the questions for the dialogic interaction was clear and how important it was to hear what the children said about what they had recorded in the iconographic form. The intern recognized relevant and inseparable the reflection on what she did/did not do in the session, as well as the reflections on the records of the learning that she was doing in situ throughout the observations. Thus, the relevance of reflective practice was confirmed (Salīte, Fjodorova & Ivanova, 2021; Feldman et al., 2018; Riel, 2017) in this construction of the professional profile.

2nd Session

The session started with the children seated on the floor and arranged in a U-shape. The following question was asked: "Do you still remember the story "The Iara and Water Pollution?" The children were enthusiastic in the (re)telling of this story. "How can we prevent the garbage from reaching the river?" The children were challenged to view the film "Let's Go Recycle – GOMBBY", lasting 3:08 minutes. They listened carefully to the song about recycling. The film aims to create a context that provides the link between river pollution, garbage, human practices and how fundamental it is to prevent them.

The dialogue continued to be given priority (interactive questioning) in the exploration of this didactic resource (film with music). Some of the questions asked: "Do you know what the ecopoints are for?"; "What are colors of the ecopoints?"; "What do we put in the blue ecopoint? And in the green?"; "Where should I put the juice straw?"; "What is the color of the ecopoint where I put the batteries?"; "Where should I put the fruit peels?" In this last question, the children observed that it was not in the recycling bin, but in the organic waste container. Some claimed that this container was green, and others claimed that it was grey. Assuming that these children were attentive to the film and concerning their surroundings, a challenge was created (the game "Identification and Separation of Waste") in which everyone had direct action. In this game, the children, sitting in a U-shape, chose, identified (glass bottle, plastic bottle, paper box, metal ...) and placed the object (trash) in the respective recycling bin (present in the activities room). This activity proved to be effective in awakening in these children the importance of the colors of the ecopoints (identifying their function). In the records carried out (DS2), all the children painted the four ecopoints with the four colors (blue, yellow, green and red) and revealed that they enjoyed the activity.

In the reflection/evaluation of the activities of the 2nd session, it was considered that there was an advantage in encouraging the retelling, as well as the mediation provided by the previously structured questioning.

3rd Session

The session began with the following questions: "Who still remembers the story "Iara and Water Pollution?"; "Who still remembers the movie "Let's Go Recycle – GOMBBY?" The group, sitting on the floor and arranged in a U-shape, showed vivacity reflected in "raising the hand" to express the ideas. The intern used a hand puppet, which she introduced to the group as João, and started a dialogue with the children. The need to know what João had to tell the group was created. João was a boy who needed the group to help him because he had many questions to ask, he had many doubts... Some of the questions asked by João: "What happens to garbage that we put in the recycling bin and that we do not put in the recycle bin?"; "My friend António told me that he throws the plastics on the floor. Who does it like António?"; "What are the ecopoints for?"; "I heard a story that said that plastics pollute rivers. What is a polluted river?"; "What's the name of our city's river?" At this moment, the intern placed cardboard illustrated with the fauna and flora existing in the river in the city park, so that the whole group could see it. João asks: "I don't know what these animals are called"; "Do these animals exist in our city's river?"; "Have you ever seen any of these animals in the river?"; "Is this a tree? What is your name? Do you live by the river?"; "Which plants live by the river?"; "In polluted rivers are there also these animals?" In

the end, the intern helped the group with a message for João: "We cannot pollute. We must use the ecopoints. In polluted rivers, the living beings that live there will eventually die. We have to be friends with Nature".

This was followed by the realization of the "Memory Game". The cards in this game were illustrated with diverse images of fauna and flora present in the natural park. Children had to identify and find the pair (fauna and flora). The game was played together, with mutual help, memorization and concentration being encouraged. None of the children showed difficulties in performing this activity. It was, from the outset, the commitment that next week we would go to discover the river in the city's natural park. The group's interest was conquered.

4th Session

The 4th session – activity in the city's natural park – began with a walk with several stops so that the whole group could observe and identify the different specimens of fauna and flora and whether there were objects polluting the park. The dialogue appealing to how important it was to take care of nature was a constant throughout the journey.

In the end, there was a snack. The intention was to promote conviviality/leisure. At the end of this moment, we returned to the cognitive and affective challenges concerning living beings and river water. Once again there was a dialogue (reinforcement/consolidation of the (re)construction of knowledge and attitudes) about what they had learned in the park. Some questions asked: "What animals did we see in the river?"; "What are the names of the trees we have been observing?"; "Are there pollutants in the river?"; "What polluting objects did we see in the park?"; "In which ecopoint should these objects be placed?".

In this context of playfulness, in an outdoor environment, three games followed, two of which were the same as those played in the activities room:

(i) "Silence and Concentration Game" – in this game the children were motivated to close their eyes, for a few minutes, and listen to the sounds/noises of the surroundings. The entire group was enthusiastic about the challenge. After all, Nature sounded. Then, the sharing of the sounds heard was promoted. Intentionality was the connection with nature as a link to raise awareness about how important it was to take care of nature and value it, in its natural state. Studies showed that learning in nature facilitated the development of skills needed in the 21st century, such as communication skills and pro-environmental behavior (Kuo et al., 2019; Chawla, 2020; Dabaja, 2022). Both the next generation of learners and our planet will benefit from the promotion of nature connectedness (Barrable, 2019). In addition, learning environments in nature promote well-being (Kuo et al., 2019; Jimenez et al., 2021). Nothing replaces the in-situ contact with nature when the intention is to stimulate "emotional intimacy with nature" (Pyle, 1993) and "love of nature" (Soga & Gaston, 2016).

(ii) "Waste Identification and Separation Game" – in this game, the children started by removing an object from the bag (with various waste types), and identifying the material. Then, the child hided the object (at that moment all the children covered their eyes) so that two other children (chosen by the child) could look for it and place it in the respective recycling bin. When the two children found the object (garbage/waste),

they asked the group to which recycling point the object belonged. All shared opinions about the state (care versus garbage) in which they found the park.

(iii) "Pair Game" – in this game, children looked at different cards illustrated with images of fauna and flora. Then, they were placed on the picnic tablecloth, calmly. The children during the game remained quiet and focused. This was because the object of the game was to lift one's finger when two of the same cards (the pair) were placed on the picnic tablecloth (concentration and speed were required). The first to lift a finger won the respective pair, mentioning the name of the animal or tree illustrated on the card.

We found that the children, in an outdoor-natural environment, were interested and concentrated for a longer time, with greater participation and commitment, although they already knew two of the games, this was not a reason for disinterest. Bedford (2022) noted that in a nature-based learning, the intervention should be action-oriented. We admit that the natural park constitutes a didactic resource with great pedagogical potential in connection with nature and "the context, focus and stimulation for various learning situations" (Hansen & Sandberg, 2020, p. 66). As a matter of fact, the notorious importance of the game in all sessions was constant, due to the awakening of attention.

Effectively, contact with the natural environment, even if occasional, has long-term repercussions in the pro-environmental and behavioral dimensions (Collado et al., 2015), as well as the games developed in this context (Thompson et al., 2008). Nature experiences for children are therefore a crucial step toward achieving sustainable developmental goals (Giusti et al., 2018). "It is time to take nature seriously as a resource for learning" (Kuo et al., 2019, p. 1).

After the games were over, the children were given time to play freely in the surrounding space, promoting the children-nature relationship. There is great potential to promote ecocentric education through engagement in outdoor play and learning.

The evaluation of this activity led us to keep the questioning strategy for the last session, as well as the learning records in DS.

5th Session

In the last session, the children were sitting on the floor in a U-shape and began with a dialogue about going to the City Park. The children vividly showed everything they liked and learned. This was followed by the viewing of a short film "The Beautiful River" by Elisabete Trigo & Santoli (1982) to verify and consolidate learning.

All children performed the task (DS4) quickly and without difficulties. The care of 25 % of children (n=3) in the use/choice of pencils in the color of the recycling bin to connect the material/trash that belonged to them is highlighted. All children marked (with an X) the image of the animal (the tree frog) and the image of the tree (white poplar) that they had seen in the park. In evaluating the activity, all the children put on a happy face, demonstrating that they enjoyed the activity.

This was followed by the awarding of "Friend of the Environment" medals to children, aiming to reinforce their connection with nature. These medals were made from the reused materials (reuse).

Concluding Remarks

The ecocentric practice involves the appropriation of knowledge (scientific conception), ecocentric attitudes and values. During the five sessions (pedagogical-didactic practices), it was possible to observe not only a great concern of the children with the approached subject but also the acquired knowledge and ecocentric attitudes were also evident. As Harvey et al. (2020) noted, this promotes nature conservation practices. Given the results of the study, it is emphasized that science education of children in preschool education oriented towards ecocentric education places future kindergarten teachers with pedagogical-didactic challenges. The teaching profession in today's world requires an ongoing process of building professional competencies to be able to meet humanity's key challenges. Developing critical thinking through the pedagogical practices, reflective practice (Mata et al., 2018) and action research methodology (Feldman et al., 2018; Salīte et al, 2016) can be a valuable tool for achieving this goal. Our results are encouraging in the face of observed learning (during games and dialogic interactions supported by the reading of stories, resources for movie viewing and dramatization, with puppet) and monitored through the didactic scripts. It is important to emphasize the importance of constant dialogic interaction, the strategy followed to build bridges and launch challenges for the child to experience. It should be noted that the continuum between sessions (indoors and outdoors) proved to be an asset for more significant learning.

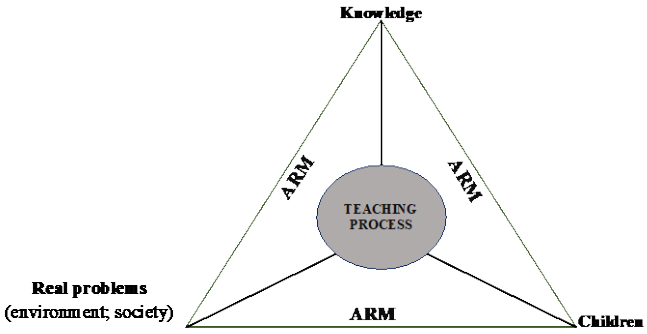
(ii) Traineeship Report

To promote ecocentric education, the need of planning educational environments was highlighted. The importance of ARM in pedagogical practice was also underlined. Developing action research requires both a positive attitude and skills (Gutierez & Kim, 2018). The worthiness of teamwork over the training pathway was also stressed. It was highlighted that the time spent in work meetings (conception of didactic sequence, action, and post-action) had been worth it.

The following important points of the pedagogical learning process were distinguished: systematic critical reflection attitudes about effective science teaching in the promotion of a sustainable world; commitment of science teaching to education for environmental citizenship through the (re)direction of attitudes and behaviors (action); the logical sequence of pedagogical practices for engaging children with the natural contexts (outdoor learning), highlighting feelings of belonging to nature; the need for monitoring the children's conceptions, noting that there is the need for didactic resources.

The methodological options in the design of the pedagogical-didactic sequence revealed to have potential for effectiveness in the science teaching-learning process, which would promote "sustainability citizens" (Wals, 2015; Wals & Lenglet, 2016). In this regard, the self-reflexive spiral of practice itself and research on how to improve the next ecocentric practice (Figure 4) was crucial in this learning to "be a kindergarten teacher" with ecocentric action.

Figure 4
Using Action Research Methodology



The trainee considered that ARM was a key for developing innovations in the teaching-learning process and their professional growth. This perspective relates to the importance of developing research skills as future educational professionals (Dunn et al., 2008; Fedosejeva et al., 2018; Heasly et al., 2020) as well as to the value of research in their classroom practice. As Sumaryanta et al. (2019) point out, there is a need to encourage teachers to construct new knowledge and skills. Whereas the teaching-learning process can become a didactic obstacle to learning, the role of pedagogical supervision is crucial. As it is underlined by Salīte et al. (2021, p. 156), "living experience [becomes] the basis of the self-experience". Tsevreni (2021, p. 14) highlighted the influence of "teacher's own relationship with nature and the environment". The training of future teachers is viewed "as the main agent of change and transition towards sustainability in society" (Pegalajar-Palomino et al., 2021, p. 99).

Conclusion

We live in a rapidly changing world in which environmental problems need a robust strategy of education. The unprecedented crossroads of the planet's sustainability means that higher education teacher training institutions must ensure an adequate level of preparation (didactics and scientific knowledge) in line with the framework of sustainable development goals and objectives. It is an arduous challenge and, therefore, requires a well-prepared and motivated traineeship supervisor. These supervisors should maintain the focus on the increasingly worrying state of the biosphere. There is a need for future kindergarten teachers to be proactive in this task. This requires substantial changes in training. The traineeship cannot be reduced to several didactic-pedagogic "principles" that "trainee teachers" can use in the "classroom". However, developing ecocentric action, although desirable, is not an easy task. It is necessary to be an eternal learner and researcher of didactics.

We believe that effective science teaching allows for the development of environmental values. Thus, in this study, the science teaching practices were intentional and conscious. The findings highlighted the merits of the methodological perspective adopted, given the learning levels evidenced by children and the traineeship report. The most important insight gained from this study was to bring the focus of the training of future kindergarten teachers on ecocentric action to the pedagogical internship. However, generalizability of this study is considered a

limitation because it was a one-off intervention, with just one trainee and a group of young children. However, this limitation was an advantage, as it allowed for better monitoring, and the activities were carried out more quickly.

Based on our findings of this pedagogical research into an effective pathway of ecocentric development of professional empowerment, we came to the following conclusions: Science teaching must be committed to environmental values; reflective-critical thinking of pedagogical practices in science teaching should be focused on the designs of ESD; action research contributes to (re)constructing the meaning of ecocentric educational practice (what is taught and how it is taught); the efficient structure of the teaching-learning process (dialectic methodology): (1) to understand conceptions; (2) to promote scientific conception in classroom (indoor) context linked to the natural outdoor contexts; (3) to confront the previous conceptions vs scientific conception; (4) to monitor learning (focus on assessment of teaching and learning process); (5) to strengthen knowledge; (6) to value and innovate the didactic resources; (7) to build didactic scripts to record conceptions (attention needs to be given to the cognitive conflict between conceptions).

Our research highlights that although the challenges of developing ecocentric action are complex, there are didactic (possible) pathways, and higher education teacher training institutions need to align with research and pedagogical practices within the scope of ecocentrism. The pre-service training of kindergarten teachers is a complex didactic-pedagogical "ground", but it is possible to transform and re-signify, for this reason, the research focused on professional didactics. To this end, the pedagogical traineeship university supervisor can play a central role and be a key element to (re)orientate future kindergarten teacher training in science teaching on ecocentric action.

The findings highlighted the merits of the methodological perspective adopted, given the learning levels evidenced by children and the traineeship report. The most important insight gained from this study was to bring the focus of the training of future kindergarten teachers on ecocentric action to the pedagogical internship. However, generalizability of this study is considered a limitation because it was a one-off intervention (only one student trainee and a small group of children). However, this limitation was an advantage, as it allowed for better monitoring, and the activities were carried out more quickly.

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References

Alves, F. R. V. (2020). The Professional Didactics (PD): Implications for teacher education and the teaching of specific disciplines in Brazil. *Revista Iberoamericana de Estudos em Educação*, *15* (4), 1–22.

Akyeampong, K., Lussier, K., Pryor, J., & Westbrook, J. (2013). Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? *International Journal of Educational Development*, *33*(3), 272–282. https://doi.org/10.1016/j.ijedudev.2012.09.006

Azevedo, J. (2012). Nota de Apresentação: Supervisão, colegialidade e Avaliação [Editorial: Supervision, collegiality and evaluation]. *Revista Portuguesa de Investigação*, *12*, 3–5.

Barrable, A. (2019). Refocusing environmental education in the early years: A brief introduction to a pedagogy for connection. *Education Sciences*, *9*(1), 61. https://doi.org/10.3390/educsci9010061

Bedford, T. (2022). Constructing a transformative sustainability pedagogy: Teacher empowerment for a sustainable future. *Journal of Teacher Education for Sustainability*, *24*(1), 5–18. https://doi.org/10.2478/jtes-2022-0002

Bing-You, R. G., Blondea, W., Dreher, G. K., & Irby, D. M. (2017). T2 (teaching & thinking)-in-action skills of highly rated medical teachers: How do we help faculty attain that expertise? *Innovations in Education and Teaching International*, *54*(5), 409–417. https://doi.org/10.1080/14703297.2015.1093425

Bogdan, R. C., & Biklen, S. K. (2010). *Investigação qualitativa em educação: uma introdução à teoria e aos métodos [Qualitative research in education: An introduction to theory and methods*]. Porto editor.

Branco, S. M. (2002). *Iara e a poluição das águas [Iara and water pollution].* Moderna Literatura.

Carbo, L, Torres, F. S., Zaqueo, K. D., & Berton, A. (2019). Practical activities and teaching games in chemistry contents as an auxiliary tool in science teaching. *Revista de Ensino de Ciências e Matemática*, *10*(5), 53–69.

Chawla, L., & Cushing, D. (2007). Education for strategic environmental behavior. *Environmental Education Research*, *13*(4), 437–452.

Chawla, L. (2020). Childhood nature connection and constructive hope: A review of research on connecting with nature and coping with environmental loss. *People and Nature*, *2*(3), 619–642. https://doi.org/10.1002/pan3.10128

Clark, C. (1993). Transformative learning*. New Directions for Adult and Continuing Education*, 57, 47–56. https://doi.org/10.1002/ace.36719935707

Cohen, L., Manion, L., & Morrison, K. (2000). *Research methods in education*. Routledge Falmer. http://dx.doi.org/10.4324/9780203224342

Collado, S., Corraliza, J. A., Staats, H., & Ruíz, M. (2015). Effect of frequency and mode of contact with nature on children's self-reported ecological behaviors. *Journal of Environmental Psychology,* 41, 65–73. https://doi.org/10.1016/j.jenvp.2014.11.001

Correia, N., Camilo, C., Aguiar, C., & Amaro, F. (2019). Children's right to participate in early childhood education settings: A systematic review. *Children and Youth Services Review*, *100*(7), 6–88.

Dabaja, Z. F. (2022). The Forest School impact on children: Reviewing two decades of research. *Education 3–13*, *50*(5), 640–653.

Dunn, M., Harrison, L. J., & Coombe, K. (2008). In good hands: Preparing research-skilled graduates for the early childhood profession. *Teaching and Teacher Education*, *24*, 703–714.

Engel, G. I. (2000). Pesquisa-ação [Action Research]. *Educar*, *16*, 181–191.

Esteves, M. L. (2008). *Visão panorâmica da investigação-acção [Overview of action research]*. Porto Editora.

Farias, M., & Cândido, L. (2019). Use of ludic didactic-pedagogical materials by PROFMAT effects and its influence on learning in mathematics in Alagoas. *Revista de Ensino de Ciências e Matemática*, *10*(6), 340–359.

Fedosejeva, J., Boče, A., Romanova, M., Iliško, D., & Ivanova, O. (2018). Education for sustainable development: The choice of pedagogical approaches and methods for the implementation of pedagogical tasks in the Anthropocene age. *Journal of Teacher Education for Sustainability, 20*(1), 157–179. https://doi.org/10.2478/jtes-2018-0010

Feldman, A., Altrichter, H., Posch, P., & Somekh, B. (2018). *Teachers investigate their work. An introduction to action research across the professions*. Routledge. https://doi.org/10.4324/9781315398822

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/10.2478/jtes-2021-0010

Ferreira, M. E., & Pitarma, R. (2021). Enhancing ecocentric environmental attitudes: An experience of science teaching to inspire students to value trees. *Journal of Teacher Education for Sustainability*, *23*(1), 132–149. https://doi.org/10.2478/jtes-2021-0010

Fontes, P. J. (2004). Action competence as an integrating objective for environmental education. *Canadian Journal of Environmental Education,* 9, 148–162.

Ghorbani, S., Jafari, S. E. M., & Sharifian, F. (2018). Learning to be: Teachers' competences and practical solutions. *Journal of Teacher Education for Sustainability, 20*(1), 20–45. https://doi.org/10.2478/jtes-2018-0002

Gill, T. (2014). The benefits of children's engagement with nature: A systematic literature review. *Children, Youth and Environments, 24*(2), 10–34. https://doi.org/10.7721/chilyoutenvi.24.2.0010

Giusti, M., Svane, U., Raymond, C. M., & Beery, T. H. (2018). A framework to assess where and how children connect to nature. *Frontiers in Psychology, 8*, 2283. https://doi.org/10.3389/fpsyg.2017.02283

González-Weil, C., Cortéz, M., Bravo, P., Ibaceta, Y., Cuevas, K., Quiñones, P., Maturana, J., & Abarca, A. (2012). Approach to inquiry as orientation to science teaching: A study about innovative practices of science teachers in secondary education classrooms of the Region of Valparaiso, Chile. *Estudios Pedagogicos, 38*(2), 85–102. https://doi.org/10.4067/S0718-07052012000200006

Gustafsson, P. E., Szczepanski, A., Nelson, N., & Gustafsson, P. A. (2011). Effects of an outdoor education intervention on the mental health of schoolchildren. *Journal of Adventure Education and Outdoor Learning*, *12*(1), 63–79.

Gutierez, S. B., & Kim, H. B. (2018). Peer coaching in a research-based teachers' professional learning method for lifelong learning: A perspective. *Alberta Journal of Educational Research, 64*(2), 214–221.

Hansen, A. S., & Sandberg, M. (2020). Reshaping the outdoors through education: Exploring the potentials and challenges of ecological restoration education. *Journal of Outdoor and Environmental Education*, *23*, 57–71. https://doi.org/10.1007/s42322-019-00045-3

Harvey, D. J., Montgomery, L. N., Harvey, H., Hall, F., Gange, A. C., & Watling, D. (2020). Psychological benefits of a biodiversity-focussed outdoor learning program for primary school students. *Journal of Environmental Psychology*, *67*, 101381. https://doi.org/10.1016/j.jenvp.2019.101381

Heasly, B., Lindner, J., Iliško, Dz., & Salīte, I. (2020). From initiatives, to insights, to implementation of the sustainability and securitability agenda for 2030. *Discourse and Communication for Sustainable Education, 11*(1), 1–4. https://doi.org/10.2478/dcse-2020-0001

Hodson, D. (1998). *Teaching and learning science: Towards a personalized approach*. Open University Press.

Jensen, B. B., & Schnack, K. (2006). The action competence approach in environmental education. *Environmental Education* Research, *12*, 471–486. https://doi.org/10.1080/13504620600943053 (Original work published 1997)

Jimenez, M. P., DeVille, N. V., Elliott, E. G., Schiff, J. E., Wilt, G. E., Hart, J. E., & James, P. (2021). Associations between Nature Exposure and Health: A Review of the Evidence. *International Journal of Environmental Research and Public Health, 18*(9), 4790. https://doi.org/10.3390/ijerph18094790

Kyle, W. C. (2020). Expanding our views of science education to address sustainable development, empowerment, and social transformation. *Disciplinary and Interdisciplinary Science Education Research*, *2*, 2.

Kuo, M., Barnes, M., & Jordan, C. (2019). Do experiences with nature promote learning? Converging evidence of a cause-and-effect relationship. *Frontiers in Psychology*, *10*, 305. https://doi.org/10.3389/fpsyg.2019.00305

Mata, A., Hernández, P., & Centeno, G. (2018). Reflective practice in postgraduate teachers, understand to transform. *Innoeduca*. *International Journal of Technology and Educational Innovation*, *4*(1), 36–43. https://doi.org/10.24310/innoeduca.2018.v4i1.3594

DGE (Direção Geral da Educação). (2016). *Orientações Curriculares para a Educação Pré-Escolar* [*Curriculum Guidelines for Preschool Education]*. Ministério da Educação.

O'Sullivan, M. (2006). Lesson observation and quality in primary education as contextual teaching and learning processes. *International Journal of Educational Development*, *26*(3), 246–260. https://doi.org/10.1016/j.ijedudev.2005.07.016

Pegalajar-Palomino, M., Burgos-García, A., & Martinez-Valdivia, E. (2021). What does education for sustainable development offer in initial teacher training? A systematic review. *Journal of Teacher Education for Sustainability, 23*(1), 99–114. https://doi.org/10.2478/jtes-2021-0008

Perrenoud, P., Altet, M., Lessard, C., Paquay, L. (dir.). (2008). *Conflits de savoirs en formation des enseignants. Entre savoirs issus de la recherche et savoirs issus de l'expérience [Knowledge conflicts in teacher training. Between knowledge derived from research and knowledge derived from experience]*. De Boeck.

Piaget, J. (1970). *Epistemologia Genética [Genetic Epistemology]*. Petrópolis.

Piasentin, F. B., & Roberts, L. (2018). What elements in a sustainability course contribute to paradigm change and action competence? A study at Lincoln University, New Zealand. *Environmental Education Research, 24*(5), 694–715.

Pyle, R. M. (1993). *The thunder tree: Lessons from an urban wildland*. Houghton Mifflin.

Rivkin, S. G., Hanushek, E. A., & Kain, J. F. (2005). Teachers, schools, and academic achievement. *Econometrica*, *73*(2), 417–458.

Riel, M. (2017). *Understanding action research.* Pepperdine University, Center for Collaborative Action Research. https://base.socioeco.org/docs/center_for_collaborative_action_research.pdf

Robinson, L., & Vaealiki, S. (2018). Ethics and pedagogy at the heart of early childhood education for sustainability. In J. M. Davis (Ed.), *Young children and the environment. Early education for sustainability* (pp. 103–123). Cambridge University Press**.** https://doi.org/10.1017/CBO9780511845390.007

Salīte, I., Drelinga, E., Iliško, D., Oļehnoviča, E., & Zariņa, S. (2016). Sustainability from the transdisciplinary perspective: An action research strategy for continuing

education program development. *Journal of Teacher Education for Sustainability*, *18*(2), 135–152. https://doi.org/10.1515/jtes-2016-0020

Salīte, I., Fjodorova, I., & Ivanova, O. (2020). Editorial: Does the JTES help us create deeper personal meanings for sustainable education? *Journal of Teacher Education for Sustainability*, *22*(1), 1–6. https://doi.org/10.2478/jtes-2021-0011

Salīte, I, Fjodorova, I., & Ivanova, O. (2021). Editorial: Towards more personal and integrated understanding of the sustainability phenomenon *Journal of Teacher Education for Sustainability*, *23*(1), 1–4. https://doi.org/10.2478/jtes-2021-0001

Salīte, I, Fjodorova, I., Butlere, I., & Ivanova, O. (2021). More personal knowledge for more sustainable higher education. *Journal of Teacher Education for Sustainability*, *23*(1), 150–165. https://doi.org/10.2478/jtes-2021-0011

Salīte, I., Fjodorova, I., & Ivanova, O. (2022). Editorial: When our will is big, the obstacles are small! *Journal of Teacher Education for Sustainability*, *24*(1), 1–4. https://doi.org/10.2478/jtes-2022-0001

Santana, E. M., & Rezende, D. B. (2007). Alchemical speedway: The use of games in chemistry teaching in the light of the Vygotsky´s theories and content analysis. In *Encontro de Pesquisa em Ensino de Química*, 4, São Paulo (USP), Anais: São Paulo.

Soga, M., & Gaston, K. J. (2016). Extinction of experience: The loss of human-nature interactions. *Frontiers in Ecology and the Environment*, *14*(2), 94–101. https://doi.org/10.1002/fee.1225

Sumaryanta, Mardapi, S., Sugiman, & Herawan, T. (2019). Community-based teacher training: Transformation of sustainable teacher empowerment strategy in Indonesia. *Journal of Teacher Education for Sustainability, 21*(1), 48–66. https://doi.org/10.2478/jtes-2019-0004

Thompson, C. W., Aspinall, P., & Montarzino, A. (2008). The childhood factor: Adult visits to green places and the significance of childhood experience*. Environment and Behavior, 40*(1), 111–143. https://doi.org/10.1177/0013916507300119

Trigo, E., & Santoli. (1982). *O Belo Riozinho [The Beautiful River]*. Cedibra: Rio de Janeiro.

Tsevreni, I. (2021). Nature journaling as a holistic pedagogical experience with the more-than-human world. *Journal of Environmental Education*, *52*(1), 14–24. https://doi.org/10.1080/00958964.2020.1724854

UNESCO. (2008). *Education for sustainable development policy dialogue: EFA ESD dialogue: Educating for a sustainable world*. UNESCO.

UNESCO. (2012). *Education for sustainable development: Sourcebook.* https://unesdoc.unesco.org/ark:/48223/pf0000216383

UNESCO. (2018). *Issues and trends in education for sustainable development.* https://en.unesco.org/sites/default/files/issues_0.pdf

UNESCO. (2019). *Roadmap for implementing the Global Action Programme on education for sustainable development*. http://unesdoc.unesco.org/images/0023/002305/230514e.pdf

UNESCO. (2021). *Learn for our planet – A global review of how environmental issues are integrated in education*. https://unesdoc.unesco.org/ark:/48223/pf0000377362

UNESCO. (2021a). *Repenser nos futurs ensemble: un nouveau contrat social pour l'éducation. Rapport de la commission internationale sur les futurs de l'éducation [Rethinking our futures together: A new social contract for education. Report of the International Commission on the Future of Education.].* https://unesdoc.unesco.org/ark:/48223/pf0000379705

Vygotsky, L. S. (1989). *A formação social da mente [The social formation of the mind].* Martins Fontes.

Vygotsky, L. S. (1994). *Pensamento e linguagem [Thought and language]*. Martins Fontes.

Wals, A. E. J. (2015). *Beyond unreasonable doubt. Education and learning for socio-ecological sustainability in the Anthropocene*. Wageningen University.

Wals, A. E. J., & Lenglet, F. (2016). Sustainability citizens: Collaborative and disruptive social learning. In R. Horne, J. Fien, B. Beza & A. Nelson (Eds.), *Sustainability citizenship in cities: Theory and practice* (pp. 52–66). Routledge.

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