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Science Education Journals as Hosts of Environmental Education Research: Perspectives and Trends in the 21th Century

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ABSTRACT

Scholarly journals are not passive receptors of scientific information. On the contrary, they, within the process of filtrating the kind of research that will finally been published, contextualize a scientific field. In the present review I examine the Environmental Education related articles published in science education journals between the years 2000 and 2014. It turned to be that EE-related research published in science education journals is characterized by an emphasis on the development and study of inquiry-oriented educational settings in both indoor and outdoor learning environments, as well as a preference for studies on biodiversity and increasingly on climate change, while research questions cover a wide range of topics (although not in equal terms) extended from the study of conceptual understanding and psychological characteristics to the development of cognitive skills and the elaboration of community oriented actions. Methodological approaches are characterized by flexibility, while an important amount of EE-related research is produced in science departments. A lack of research on early childhood as well as on adult education and a need on greater emphasis on learning for empowerment and active participation are the most important weakness of the literature under review.

KEYWORDS
environmental education, environmental education research, literature review

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Introduction

The profile of environmental education-related (EE-related) research that was published in science education journal between 2000 and 2014 is examined in this paper (the term "environmental education-related" was firstly used by Dillon and Scott (2002) in their introduction of a special issue of the Science education journals have always been a willing host of environmental education research. They actually are the second largest source of environmental education research

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articles (following the journals devoted exclusively to environmental education - Baytak, 2011), and they therefore significantly contribute to the shaping of the profile of environmental education research. ,

Scholarly journals are not passive receptors of scientific information. On the contrary, they, within the process of filtrating the kind of research that will finally be published, contextualize a scientific field. As such, they constitute crucial mechanisms for defining professional identities and communicating the distinctive practices that would constitute them (Tomlins, 1998). Journals play a central role in the process of communication, scrutiny and acceptance of scientific ideas (Schafner, 1994). They are the primary means of communicating research results and they serve as primary vehicles of communication between disciplines and within disciplines. As Tsai and Wen (2005) stated, a systematic analysis of articles published in scholarly journals may be helpful in revealing the current status and recent trends of research on a topic and thus assisting researchers and educators to more broadly understand their field and orienting their own research (Erdogan et al, 2009; Sozbiliz & Kutu, 2008).

Following the above line of reasoning, I try in the present review to depict the current profile of environmental education research as it is generated through the EE-related papers published between 2000 and 2014 in science education journals. I start my analysis with the papers published in year 2000 in order to include the papers published from the start of the 21th century. Since the reading, selection and analysis of papers included in this review was completed during the year 2015, I extend the pool of the reviewed papers till the end of year 2014, in order to present a review as much updated as possible.

Specifically, the elements that shape up the profile of the research field of environmental education (EE), and the arguments for their importance, are:

a) Author(s) affiliation:

The range of departments hosting EE-related research serves as an indication of the "relations" and "alliances" of environmental education in the scientific community, a matter that it is of concern for environmental education researchers (Scott, 2009).

b) Type of research

Many scholars point out that till the end of the 20th century environmental education research mainly focused on the depiction of the pro-environmental characteristics of respondents, whereas a lack of research into learning in environmental education, can be depicted. (Wals & Dillon, 2013) It is considered necessary to research more emphatically on teaching processes, learning situations and on how learners and teachers get involved in exploring issues and reflecting about them (Kyburz-Graber, 2013).

c) Environmental topic of research

As Stevenson et al (2013) note, environmental education has a global and a local dimension given that the scale of environmental issues ranges from the local to the global (p.2). Ideally, environmental education research and practice should cover global issues, such as climate change, that everybody should be aware of and capable to act upon, as well as topics of local interest that could be a "top priority" for a local community of learners (Marcinkowski, 2009). Consequently, one could expect that environmental education literature would include an important number of articles focused on the global issues, as well as articles

presenting a wide diversity of topics which will depict the great variety of local issues that could be of interest to specific groups of participants.

d) Aim of research

Many scholars argue that environmental education researchers had already devoted a vast amount of energy on psychological research and conceptual understanding. Steverson et al (2013) insist that one of the issues that there is nowadays broad consensus is that "environmental education is concerned not only with knowledge and understanding and attitudes and values…" (p. 2). Moreover, research on attitudes and other affective variables has been associated by many scholars of EE with the advocative version of EE, which aim in developing particular behavior rather that critical thinking and action competence (Kenis & Mathjis, 2012). Kyburz-Graber (2013) comments that "the individual behavior change concept of environmental education and a predominant natural science perspective on environmental problems are simplifications and do not form adequate approaches to the multilayered nature of environmental problems" (p. 24). Instead, scholars illuminate the necessity for research on issues such as developing agency and empowerment of learners, improving civic participation and action or developing thinking skills (Ardoin et al 2012).

e) Educational settings

Environmental education scholars are repeatedly calling for learning environments that support critical thinking, free opinion-making and worldviews' diversity which are considered significant features of a democratic environmental education (Rudsberg and Öhman, 2010). The same necessity is expressed for the development of outdoor learning as a way to bring students not only in contact with nature but also to help rise community issues, enforce collective and community learning and action and socio-ecological interactions, elements that are considered as the most important aspects for the current orientation of EE (Erdogan et al, 2013; Ardoin et al., 2012).

f) Participants

Research has shown that different age classes respond differently in environmental stimuli, express their environmental concern in different ways and qualities and have different ways of learning and acting. Therefore, it is important for research to study the different characteristics and needs of the different age classes

g) Methodological approach

The discussion over the suitability of qualitative versus quantitative methods for EE research is one of the most long-lasting ones in the field of environmental education (A. Gough 2013). Supporters of quantitative approaches are accused for positivistic, authoritative and behaviouristic conceptions of environmental education, while the supporters of qualitative research are accused for producing inconclusive, anecdotal and non-representative research, The quantitative paradigm was supposed to dominate till the late '80s while qualitative research started gaining ground in the '90s (Dillon et al., 2013).

Method

The method of content analysis was used for the purpose of the present study (Titscher et al. 2000). Content analysis constitutes a research technique for the systematic description of content. Content is systematically coded by means of the construction of categories. Thus, content analysis involves the transformation of data into categories, which express the research questions of each study. The

method of content analysis has been applied as the research and analysis method in other research literature review studies as well (Erdogan et al 2009; Erdogan et al 2013; Sozbiliz & Kutu, 2008). In the present study the following steps were followed: a) selection of the journals that constituted the textual corpus of the analysis, b) identification and application of criteria for selecting research articles, c) development of a coding schema, i.e. identifying the categories and sub-categories of the analysis, d) extraction of information from each article and classifying it in the relevant category, e) organization and presentation of the coding data, f) Interpretation and discussion of the findings (for the steps of a content analysis procedure see Erdogan et al, 2009; Erdogan et al, 2013).

Journals included in the analysis

The present study included papers published from 2000 to 2014 in International Journal of Science Education (IJSE), Science Education (SciEd), Journal of Biological Education (JBE), Research in Science Education (RiSE) and Journal of Research in Science Teaching (JRST) as the research sample. The International Journal of Environmental and Science Education was not included in the present review because it began getting published in 2006, and therefore it is not covering the whole period under consideration; another reason was its "hybrid" nature, as being a journal of both science and environmental education, while the purpose of the present review is to focus exclusively on the characteristics of papers published in "science only" scholarly journals.

Criteria for papers' selection (definition of EE-related research)

The criterion for including an article into this review was its relevance, either in a theoretical or in an empirical way, to environmental education research. Environmental education related (EE-related) research was defined as the research studying aspects of people-society-environment relationships: Studies dealing with aspects of the natural world without making any reference to people-society-environment relationships were not included in this review. The papers that fall into the categories of 'editorial', 'commentary', or 'responses', were included in the analysis, as long as they were relevant with the subject of the present review. Book reviews were excluded from the analysis.

A total of 177 articles were finally included in this review study. The longitudinal trends in the publication of environmental education-related articles in each science education journal were calculated before proceeding in the analysis of the content of each article.

Categories of analysis

The selected papers were read carefully and information pertinent to each categories was coding accordingly. The categories were defined so as to correspond to the elements constituting the profile of EE-related research as they were describe in the introduction. Subcategories were derived inductively through the data.

Specifically, the categories and sub categories were:

Authors' affiliation

Papers were classified in the following sub-categories, according to the affiliation of their author(s): a) papers written by author(s) affiliated in education

departments, b) papers written by author(s) affiliated in natural sciences departments c) papers written by authors affiliated in both educational and natural science departments and d) papers written by author(s) belonging to other departments, such as psychology or social science departments.

Type of research
Paper were classified as a) surveys, i.e. papers implementing social research through questionnaires, interviews etc., studying cognitive and affective variables, such as conceptual understanding, pro-environmental attitudes, values etc., b) educational practice research papers, i.e. papers evaluating educational activities, c) theoretical papers, d) papers analyzing textbooks.

Topic of research
The aim of this category was to depict the environmental issue that was the subject of each paper. Ten broad sub-categories were created, according to the topic discussed in each article: a) biodiversity, b) climate change (including carbon cycle and greenhouse effect), c) environment as a general concept, d) biotechnology and genetically modified organisms (GMOs), e) ozone depletion, f) human health issues having a direct connection with environmental factors, g) sustainability, i) water (including water pollution issues, water supply issues, watershed management), h) nuclear power, k) "other topics": the specific sub-category was created to include subjects that appeared in no more than two papers each one.

Aim of Research
The papers under consideration were distinguished as: a) papers studying the conceptual understanding/alternative ideas/misconceptions of participants; b) papers dealing with the cognitive skills of participants, including argumentation skills, reasoning skills, and decision-making strategies skills, c) papers examining affective variables, d) papers examining humans-nature relationships, e) "others".

Educational settings
Papers dealing with educational activities were classified in four broad sub-categories: a) indoor inquiry, including educational interventions having a student-centered, active learning character, b) outdoor activities, c) indoor educational settings that had the form of teacher-centered lecture, d) Various other pedagogical approaches that occurred in no more than two papers each one were classified as "others". These included role play, museum education activities or playing and learning with living animals.

Participants
Participants were classified as: a) participants of pre-school age, b) primary school students, c) secondary school students, d) university students, e) adults and f) teachers.

Method
Papers were distinguished according if they were following a) a quantitative or b) a qualitative methodology in the analysis of their data.[3]

Results

Longitudinal trends in number of publications

The percentage of EE-related publications appearing in science education journals was increasing from 2000 till 2014 (figure 1).[1] The IJSE is the journal hosting the largest number of EE-related publications with an average of 5.66 publications per year, followed by JBE and RiSE (2 publications per year). However, due to the difference in the total number of articles that each journal publishes per year, it is the JBE that had the biggest percentage of annual EE-related publications (with an average of 6.66% per year), followed by IJSE (5.99%) and RiSE (5.39%). On average, there were 11.8 EE-related articles published in science education journals every year, which represent 4.64% of the total number of articles published in them.

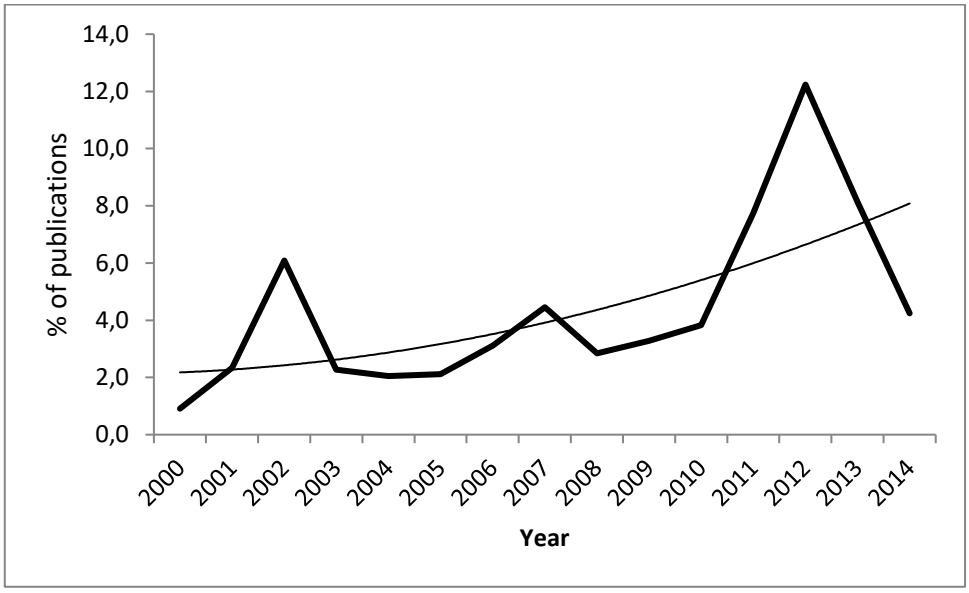

Fig 1: longitudinal trend of EE-related publications in science education journals

Authors' Affiliation

One-hundred and one of the papers under consideration were published by researchers affiliated to educational departments. Another 47 papers were written by authors affiliated with natural sciences departments (mostly biology and environmental sciences departments, but also departments of physics, agricultural sciences and forestry). There were twenty-one papers written by groups of co-authors belonging to both educational and natural sciences departments. Eight papers were written by authors belonging to other departments, specifically psychological and sociological ones.

Type of Research

Implementation and evaluation of educational activities was the subject of the majority of the papers under consideration (95 papers). Social surveys were the focus of 64 out of the 177 papers, constituting a quite large part of the total sample. However, the relative weight of social research tends to decrease during the recent years, in favor of educational case studies (fig. 2). Fifteen papers dealt with

theoretical issues, while five papers analyzed school textbooks content. Textbooks' analysis papers appeared only sparsely across the years, while theoretical papers tend to appear more often before 2008 than during the more recent years.

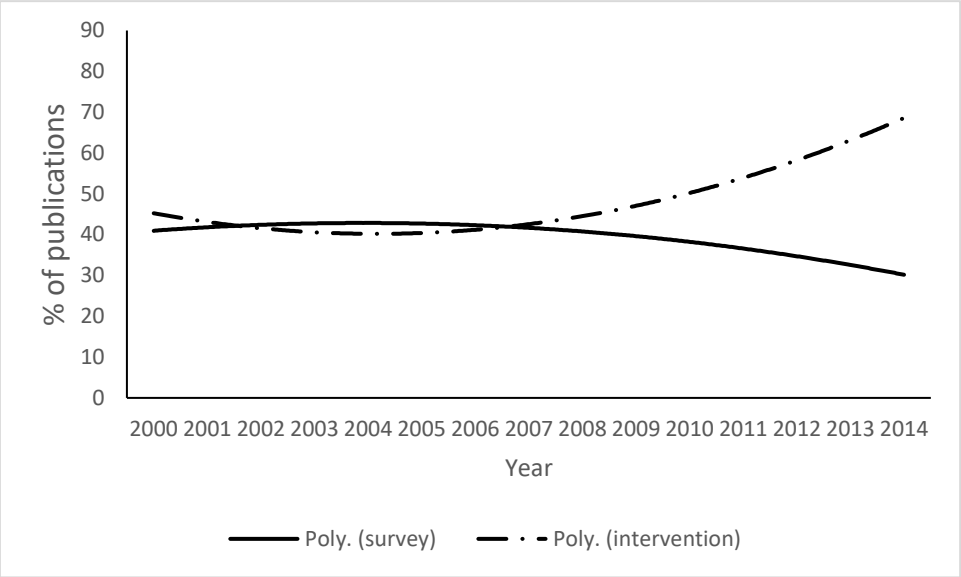

Fig 2: trend of the percentage of articles concerning social research and educational interventions in relation to the total number of EE-related publications in science education journals

Topic of research

Biodiversity was the main environmental topic attracting the interest of researchers: It was the focus of 57 papers of the sample. A number of other environmental issues occurred in a smaller number of papers, with the most prevailing among them being the issues of climate change (35 papers), GMOs (15 papers) and of the depression of the ozone layer (8 papers). A cluster of 15 papers was classified as presenting the topic "environment", because they focused on the environment as a general concept and not on specific elements of it. Nine papers dealt with health issues, six with water issues, five with nuclear power, while ten had as their topic the concept of sustainability. Finally, various topics included in 26 papers were classified as "others" since no one of them was appearing more than a couple of times in the selected literature. The topic of climate change tend to increase as a choice of researchers during the recent years, while the other main topics exhibited a slight tendency to decrease (Fig. 3)

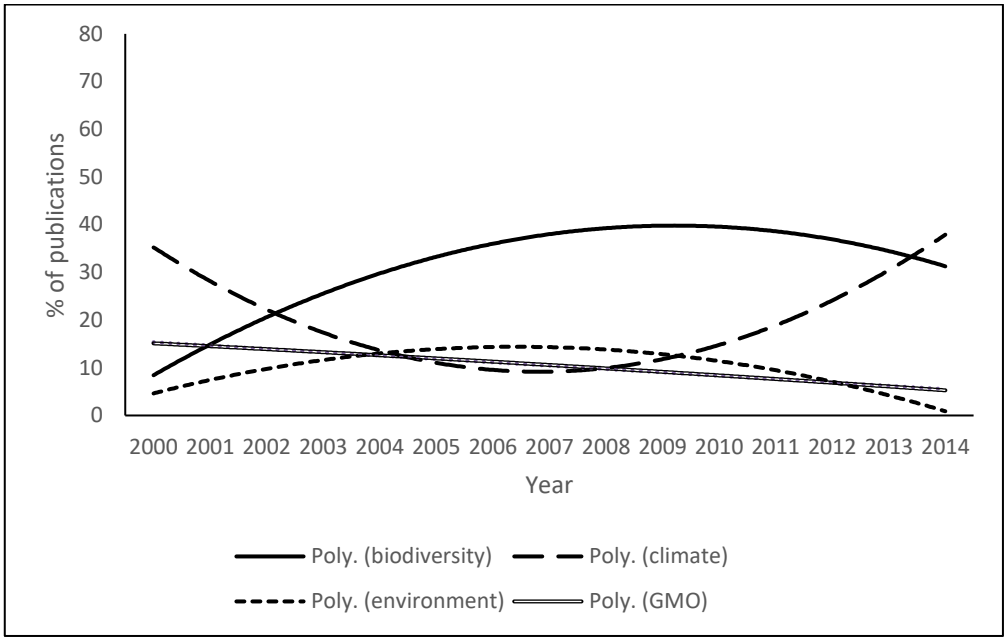

Fig 3: trends of the main environmental topics presented in EE-related publications in science education journals

Papers on biodiversity cover a wide range of themes extended from the focus on specific species (e.g. the paper of O'Byrne (2009) on improving second graders knowledge and thinking about wolves), to the study of general issues on teaching biodiversity (e.g. van Weelie & Wals (2002) on how to make the concept of biodiversity meaningful through environmental education). Papers on local ecosystems and local species include works such as that of Prokop et al. (2010) on high school students attitudes towards spiders, or the paper of Lee and Grace (2010) on students reasoning and decision making about bat conservation, as well as the paper by Sukhontapatipak and Srikosamatara (2012) which is applying an action research approach to the study of the university campus wetland.

Papers on greenhouse effect and climate change range from the study of knowledge about and attitudes towards the problem (Boyes et al., 2009; Hansen, 2010) to the use of climate change as an instance for the study of participants' conceptualization of the nature of science (Sadler et al., 2004), or even to the implementation of social activistic educational approaches (Lester et al., 2006), and the design of proper curriculum for conceptual understanding (Mohan et al., 2009; Svihla & Linn 2012).

Papers on "environment" include those measuring environmental attitudes based on quantitative instruments applied on large samples of participants, like the work of Peuw and Petegem (2011), measuring the effect of "Eco-school" projects on school children environmental attitudes, knowledge and affect in Belgium, or the paper by Fernandez-Manzanal et al. (2007) evaluating Spanish university students environmental attitudes.

Papers on biotechnology and genetic modification focus mostly on the evaluation of educational practices and the development of effective teaching approaches, like the work of Simonneaux on the use of role-play and debating strategies for dealing with trangenesis in classroom (Simonneaux 2001; 2002), or the development of inquiry-based curriculum for the teaching of issues on genetically modified food (Seethaler & Linn, 2004).

Research on ozone layer depletion has mainly the form of social surveys on participants' conceptual understanding of the issue. It's also worthy to mention that these papers, with the exception of Kaya (2009), do not deal exclusively with the issue of ozone layer. Instead, the degradation of ozone layer is just one of the topics each article is studying.

Health education issues are used mainly as means for the development of reasoning abilities and argumentation on SSI. Power lines (Kolsto, 2001), mobile phones (Pouliot, 2008), or hazardous household items (Malandrakis, 2006), are among the specific topics discussed.

The papers of the category "sustainability" discuss ways of transforming educational curricula towards the perspective of sustainability, as for e.g. the paper by Mueler and Bentley (2007) which suggest a "pluralistic landscape" of education, promoting the conservation of Earth's natural environment, or the paper by Aighewi and Osaigbovo (2010), which discuss how university students face the greening of tertiary education.

Aim of research

The larger number of the articles (55) included in this review focus on the conceptual understanding of the issues under consideration. Papers of this sub-category study participants' conceptual constructions of the environment and the environmental issues. Examples include research on middle school pupils understanding and meaning construction of subjects such as the greenhouse effect and the ozone layer depletion (Osterlind, 2005), or on the way preschool children interpret human actions like hunting and their environmental impact (Ergazaki & Andriotou 2010). The transformation of conceptual understanding after educational intervention was often the subject of those studies (Lester et al,. 2006; Mohan et al., 2009).

Studies on affective variables constituted the second largest sub-category of this section (51 articles). This category consisted mainly of articles measuring pro-environmental attitudes by quantitative questionnaires (Semken & Butler Freeman 2008; Fonseca et al. 2011). There were also a fistful of papers studying values and moral issues in a qualitative manner (Grace & Rattcliffe 2002; Sternäng & Lundholm 2011).

The third sub-category of articles, according to their aim of research, included papers researching cognitive skills such as argumentation, reasoning skills, and decision making strategies (43 papers). The papers of this category exhibited an almost equally distribution between the study of decision making skills and decision making strategies of participants from the one hand (Evagorou et al.,

2012; Kolsto, 2001; Seethaler & Lin, 2004), and argumentation skills and debating strategies from the other (e.g Kolsto, 2006; Simonneaux, 2002). Papers combining the study of different skills were not uncommon (Jimenez-Alexaindre, 2002; Lee & Grace, 2010; Walker & Zeidler, 2007).

Thirty papers dealt with ways to improve pro-environmental curricula and/or educators' capacity and teaching efficiency. A number of them were included in two special issues, one in the IJSE 2002, on the possible mutual agenda of science education and environmental education and the other in RiSE 2012, on the connection of socio-scientific issues and Education for Sustainability in contemporary education. Most of the papers of this category explore ways for developing and evaluating "pro-environmental" curricula both in formal (Colucci-Gray et al., 2006; Hansmann, 2009) and informal settings (Ruiz-Mallen et al., 2010) . There were also articles on students' ideas on "greening" the university curriculum (Aighewi & Osaigbovo, 2010), on educators beliefs about pedagogy and classroom practices (Gardner & Jones, 2011; Hwang 2011), and on teachers' competence (Lindemann-Matthies et al,. 2011).

Eight papers dealt with human/nature relationships as they are depicted either in school textbooks or in people's conceptual worldviews (e.g. Dove, 2011; Korfiatis et al., 2004).

Finally, six papers researched other issues, such as the importance of socio-scientific issues in environmental education (Robottom, 2012).

Figure 4 indicates a decrease of publications on conceptual understanding and an increase on curriculum and teachers' efficiency studies, as well as a slighter trend of decrease of studies on cognitive skills and a stabilazation trend of studies on affective variables.

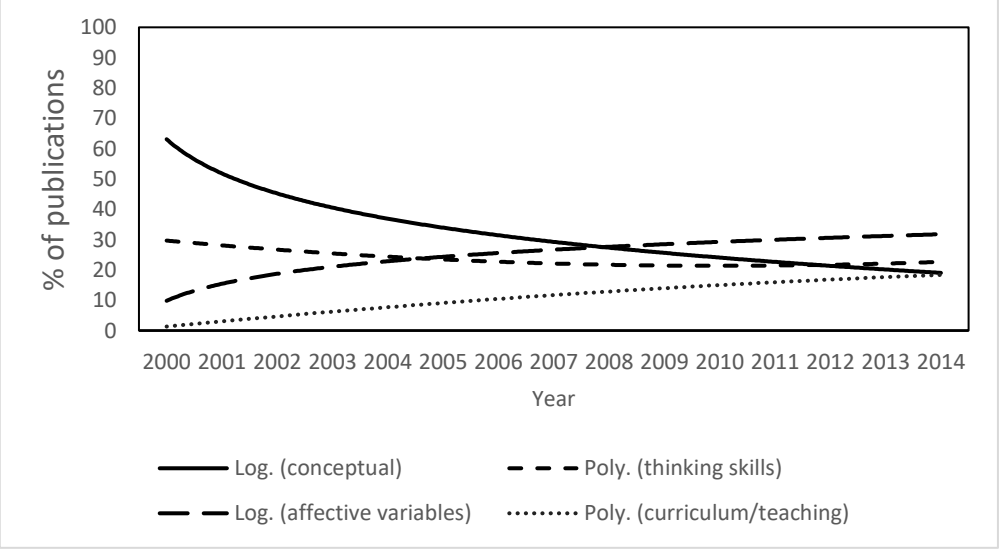

Fig. 4: trends of the main research aims presented in EE-related publications in science education journals

Educational settings

The main group of this category (it included 51 out of the 95 in total papers dealing with educational interventions) included papers that describe indoor educational activities which follow a collaborative, student-centered, inquiry-oriented approach, (Lee & Grace, 2010; Osterlind, 2005)

Outdoor activities were constituted the second largest sub-category of papers dealing with educational activities (30 out of 95 papers). In all cases, the educational approach adopted was an inquiry-oriented approach, including active investigations, hands-on or modelling activities, and environmental monitoring (Magnotrn & Hellden, 2005; Semken & Butler Freeman, 2008). An important number of articles in this category were dealing with community projects, either in a collaborative form between schools and social actors, or as community projects, involving environmental action groups, volunteers or community institutions (Gebbels et al., 2011; Ruiz-Mallen et al., 2010; Boyer & Roth, 2006; Brossard et al., 2005). Outdoor interventions tend to increase during the recent years, while indoor interventions exhibit a tendency to stabilization (fig. 5).

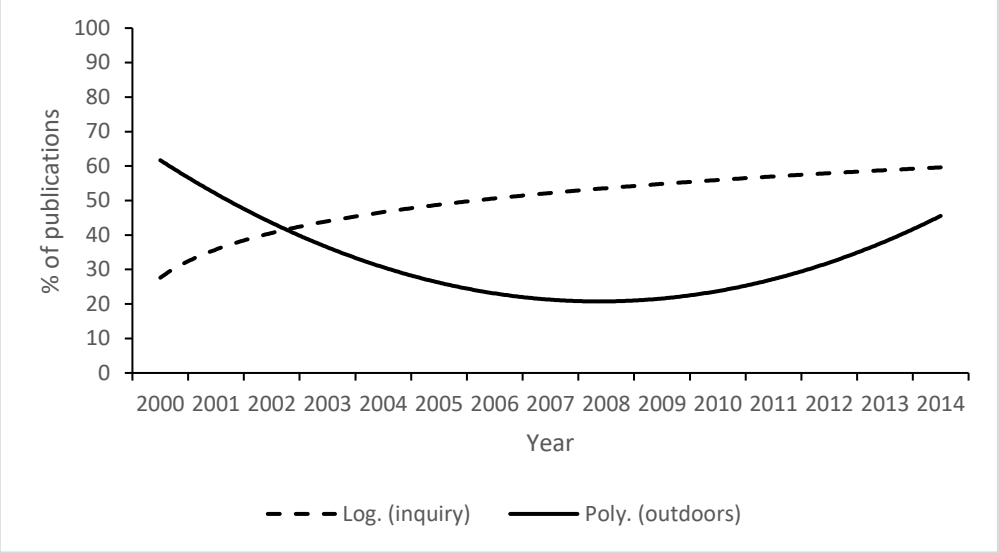

Fig. 5. longitudinal trend of the two main educational settings (indoor inquiry and outdoor settings) from 2000 to 2014.

In seven articles the educational intervention had the form of teacher-centered lectures, while other educational approaches (e.g. role play, museum visits, taking care of living organisms in the classroom) were implemented in nine papers.

An analysis of the topics studied in the different educational settings showed that the topic of biodiversity was equally chosen as a topic of study in both indoor and outdoor learning environments, while the topics of climate change, ozone layer depletion, GMOs and health issues were chosen as subjects only in indoor educational settings.

Concerning the distribution of research questions across the two main educational settings, it turned out to be that 46% of indoor inquiry educational interventions focus, on research on argumentation, reasoning and decision making, while 23% of them were dealing with conceptual understanding, 15% of them with the study of affective variables, and 12% with curriculum or teaching efficiency studies. Outdoor educational projects almost ignore the research questions about cognitive skills (only 5% of them dealt with these research questions), focusing more on research on conceptual understanding (48%) and affective variables (31%). Eleven per cent of the outdoor studies questioned curriculum and teaching efficiency issues.

Participants

The vast majority of studies included students of the secondary school (74 papers). Primary school students and university students participated in thirty two and thirty one studies respectively. Twenty one papers dealt with teachers, seven with adults and university students, and only three articles worked with pre-school children.

Type of Method

Most of the papers (93) use quantitative methodology, while 82 papers applied a qualitative approach (thirteen of the papers actually implemented mixed quantitative and qualitative methodologies). Quantitative methodology was most popular among social research articles (there were 49 articles in this category applying quantitative methodology and 21 applying a qualitative approach), while qualitative methodology prevailed among articles studying educational interventions (59 articles in this category implements qualitative methodologies and 36 quantitative ones).

Discussion

EE-related research published in science education journals is characterized by an emphasis on the development and study of inquiry-oriented educational settings in both indoor and outdoor learning environments, as well as a preference for studies on biodiversity and increasingly on climate change, while research questions cover a wide range of topics (although not in equal terms) extended from the study of conceptual understanding and psychological characteristics to the development of cognitive skills and the elaboration of community oriented actions.

Methodological approaches are characterized by flexibility and reflexivity, while an important amount of EE-related research is produced in science departments.

The fact that inquiry-oriented approaches dominated the educational settings in the articles included in this review is in accordance with the goal set by various scholars that E.E should more seriously consider constructivism and inquiry learning (Dillon & Scott, 2002). The same stands with the emphasis of educational interventions on developing thinking skills (Rudsberg & Öhman 2010; Stevenson et al., 2013). The latter finding consist a major change in comparison with the situation reported by Volk and McBeth (1997) as well as Rickinson (2001), that thinking skills had not receive enough attention till the end of the previous century.

Outdoor projects and activities exhibit an increase tendency through the years, which is in accordance with the worldwide call for supporting outdoor activities in education (Dillon et al., 2006). The volume of EE articles on outdoor learning could offer valuable insights in improving outdoor activities and strengthen their importance and impact on education.

On the negative side, although there were quite a few papers focusing on community learning and action, as well as on the development of community participation and empowerment, overall the call for "developing the agency of learners in participating and taking action on environmental and sustainability issues" (Stevenson et al. 2013, p. 14) and the connection of learners with the community seems not to have come to the forefront yet.

An important point to comment on are the many articles published on the rather well-worn topics of psychological research and conceptual understanding. Both subjects still comprise a voluminous part of the EE-related research published in science education journals, despite the arguments of various scholars that this type of research has complete its purpose (Corbett, 2006; Wray-Lake et al., 2010; Kyburz-Graber, 2013) Similar outcomes have been reported in an national survey concerning the characteristics of EE-related research in Turkey between the years 1997-2007 (Erdogan et al., 2009).

The findings of the present review show that many researchers do not dismiss the importance of research on behavior and attitudinal changes (Ardoin et al., 2012). Instead, they argue that the available evidence highlight the need for additional work on these issues, despite the overwhelming research that have already been done. The same stand for the research on conceptual understanding and alternative conceptions: one cannot underestimate the volume of misunderstandings and misinterpretations about environmental issues that characterize large samples of people and how these affect their positions and action competence (Jurin & Fortner, 2002; Kukkonen et al., 2014).

EE-research needs to widen the age-range of participants. For the moment, a concentration on the secondary school ages is observed: It is argued that pre-school age and the first years of the elementary school are critical for the construction of life long attitudes (NAAEE, 2010); however the relevant research

is limited. Similarly, it is interesting to know how adults react to community projects, their willingness to participate, and their affection by their participation, but there are only few data available yet.

Concerning the environmental issues under consideration, the popularity of articles focusing on biodiversity issues could in part be attributed to the centrality of the issue, but it could also be considered as a "convenience" choice, in the sense that biodiversity issues are usually compatible with curriculum demands, give opportunities for direct engagement with local environments, and is a popular and easily accessible topic for students. On the other hand, greater emphasis should be given to issues like that of climate change which are central for the environmental movement (Marcinkowski, 2009).

The present review of the literature revealed a trend according which specific environmental topics are used for specific purposes: Biotechnology and issues on genetically modified organisms are appearing as subjects of educational case studies, relevant with the development of argumentation and decision making skills. Ozone layer depletion is appearing in papers dealing with environmental attitudes, etc. It seems that the selection of a topic is made by its suitability for the specific purpose of the researcher or educator, and not for the importance of the environmental topic itself. A similar specialization turns out to exist as far as the research questions are concerned. A certain cross of the borders between various topics, research questions and educational settings is certainly needed.

The present review limited itself to a descriptive presentation of the profile of EE-related research published in science education journals. It is hoped that, despite limitations, it will provide some guidance for educators and researchers in making decisions when conducting research. However, more in-depth analyses on specific characteristics of the EE-related research would be more helpful in clarifying trends and tensions, as well as gaps in the undergoing research. A comparison with the research getting published in environmental education journals would be helpful as well in examining if the research characteristics depicted in the present review are similar across the range of scholarly journals or if there are "niches" of different kinds of research hosted in different journals.

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NOTES

1 The inclusion of a detailed recording and discussion of the various methodological approaches used in the papers under review would by far exceed the available limits for the present article. Therefore, I decided to include only a rough distinction between quantitative and qualitative approaches as only a small clue about the methodological trends in EE research.
2 I have not deal in this review with the research outcomes of the papers under consideration. Instead, I focus on the parameters that outline the profile of a research field.
3 The type of the trendline with the best fit on the data, as it is measured by the R2 value, is the one presented in each graph.
4 The reader can notice that the total number of "topics" (186) excludes the number of papers (177) included in the analysis. This is happening because there were papers dealing with more than one

environmental topic. The same remark stands for all the categories of analysis, since there were papers having more than one research questions, or papers combining for e.g. indoor and outdoor educational setting, or quantitative and qualitative methodologies.