



Discourse analysis to encourage environmental competence of trainee teachers. A case study.

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Date of Submission: 10-06-2022

Date of Acceptance: 25-06-2022

ABSTRACT: This work aims to evaluate specific environmental competencies of teachers in training. In view of this, the discourse of around 50 students is analysed. Small conversation groups worked in the field of the plantation of invasive vegetable species in new locations, considered of social relevance by the United Nations and included in the Sustainable Development Goals (SDGs). Research questions included: Do students know what invasive species are? Do students know that the proliferation of invasive species is an issue considered in the SDGs? Which factors influence students' mental models of invasive plants? Are students able to communicate ideas and opinions? Are they conscious of their role as teachers? Are students able to design classroom proposals to stimulate learning in this area? The main data sources were questionnaires, transcribed debates, brainstorming, and classroom proposals of students. It is worth mentioning that students displayed an initial lack of scientific vocabulary, and difficulties in verbalising their ideas. Discussion contributed to the acquisition of competences and conceptual knowledge as well as the development of student discourse, environmental awareness and scientific / social teaching skills.

KEYWORDS: Environmental education, Discourse analysis, Invasive species, Teachers in training.

I. INTRODUCTION

Language is of great importance in education. Slow or poor language acquisition restricts students from following the teachings and social life of the group, seeing the development of their abilities compromised by linguistic limitations (Santiuste, 2017). Therefore, competencies related to communication and the search for information, analysis, processing and organisation of this information are fundamental from early ages. As the main mediator of meanings as well as a tool for

revision, reformulation and construction of conceptions discourse is a transversal formative element. Language allows us to communicate, contrast, and to modify conceptions of reality. In education, it is perhaps in the argumentative organisation of exchanges and discursive productions where the formative potential lies. This potentiality is linked to the possibility that different interpretations of phenomena are expressed in discourse and that they confront or complement each other in the construction of more complex and dynamic meanings. For all these reasons, training spaces constitute privileged settings to explore this socio-cultural dimension. Through understanding the conceptions and practices of science teachers as discursively mediated constructions we can encourage critical self reflection which can influence the actions we take (Astudillo&Rivarosa, 2008). Science learning implies the appropriation and application of a language that is different from everyday language outside school. The scientific-academic discourse through which the natural, physical, social and biological experience in school is reconstructed, is characterised by an increasing degree of generalisation and abstraction that requires a conscious pedagogical intervention. On the other hand, the school must train individuals with the semiotic resources and strategies necessary to become citizens capable of continuing with their learning process throughout life, developing their identity, defending their rights, accessing and contributing to goods and community services, to build a more just and equitable society (Chamorro, Barletta & Mizuno, 2013).

At this point, discourse analysis (DA) constitutes a helpful tool to study the use of various forms of communication. It is not only what people say and how they say it, but also its impact on society and the influence of society on what people communicate. DA studies who communicates and why as well as how and when the message is



transmitted, making it possible to identify and evaluate the influence of beliefs in and through discourse (Breeze, 2011). These beliefs mark the difference between the objective explanation of real phenomena and the explanation with the influence of various aspects, such as social, political, or

This study aims to analyse the discourse of almost 50 trainee teachers on an environmental issue of current social relevance: the proliferation of invasive plant species and its consequences (Ehrenfeld, 2010; Patoilo and Oliveira, 2019; Tebboth et al., 2020). In fact, according to the SDGs pursued by the United Nations (2002), target 15 considers measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems. Countless initiatives are being implemented at all educational levels around the World to include these SDGs in the studies they teach. The Council of the European Union, held at the end of 2010, recognised that teachers and trainers of all levels of education require adequate training and competences in sustainable development skills (Council of the European Union, 2010) to promote and incorporate the underlying principles of sustainable development in their approaches to teaching and management. The United Nations International Children's Fund promulgates that it is essential to transmit competences on this subject from the first years of life (UNICEF, 2020). This will certainly contribute to the awakening of the values and attitudes characteristic of this approach that different studies have detected in the population and in specific groups (Cebrián&Junvent, 2014)

II. THEORETICAL BACKGORUND

Historical evidence of DA exists. Its scope in the last five decades has spread across several disciplines of humanities and social sciences with diverse objectives (Manzoor et al, 2019). This includes politics, academia, research, media, journalism, and many other fields (Van Dijk, 1985). Social, political and other issues can be analysed by studying certain societal conditions. DA helps in learning to express opinion about everyday issues that affect society and encourages social responsibility and social change (Herzog, 2016). In such respect, an integrated relationship between discourse analysis and critique exists (Nonhoff, 2017). Debate about the social issues that affect people helps to develop the ability to apply scientific vocabulary to explain everyday experiences. It is worth noting the importance of adapting the content to the age of the interlocutors

pragmatic (socio-cultural context, participants, situation) among others. Therefore, it is necessary in the teaching-learning process to communicate and educate on this (Orlandi, 2001; Bavelas et al., 2002).

and to the specific topic analysed (Rocha, 2012). Emotions and social context also influence meaning and the function of these explanations (Dunsmoor et al., 2015). DA research in the field of science education has been focused in recent decades on understanding problem-solving processes, the relationship of language with mental models, teacher training, and the use of texts with different purposes (Rodríguez, 2004). Conclusions focus on the acquisition of teaching competencies, the processes involved in the development of students' scientific knowledge in students, and those related to the classroom as a place of interaction. Didactics, science and everyday life must be present in students' discourse in order to contribute to the understanding of key science concepts through long-lasting learning outcomes acquired during compulsory education (Gómez et al., 2019). It is a priority issue to promote connectedness with nature through environmental education at compulsory educational stages and therefore also in the training of future teachers (Benarroch& Marin, 2011; Liefländer et al., 2013; Ruiz, Márquez & Tamayo, 2014). Knowledge develops environmental competences that have a direct effect on environmental attitudes and values (Dzhengiz&Nielsen, 2020). It is expected that trainee teachers perceive educational needs not only as curricular contents, but also with a social application and implication. Competences to develop include critical thinking, concept development, analysis and synthesis. Then, students should apply the new thinking to develop new knowledge. It will have direct application in terms of the taking of positions and even perhaps decisions when faced with environmental / health events. It is of vital importance to pay attention to the supporting role that early childhood education can perform in sustainable development and in the training of children (Davis, 2009; Gutiérrez-Pérez & Perales-Palacios, 2012). This encourages a sense of belonging to the environment where they develop, the acceptance and care of oneself, the other and their surroundings (Castro &Renés, 2018) in a framework of listening, participation and action that favours the transformation of a reality that requires change. Several studies concluded that active methodologies help children to develop constructive and sustainable ecological skills (Mileto et al.,



2017). All this is of vital importance and obliges the entire educational community especially the family, as has been shown by various authors (Weigel et al., 2006; Anderson et al., 2010; Swain & Cara, 2017), to transfer the schools' ways of teaching into the home and beyond influencing behaviours, beliefs, understanding, activities and practices.

as transmitters of knowledge. The first important goal is to analyse the extent of students' scientific

conceptual knowledge of the proliferation of invasive plant species and its consequences as well as the difficulties in acquiring such knowledge. In view of this, a number of questions emerge:

- Do students know what SDGs are?
- Do students know what invasive species are? Do students know that the proliferation of invasive species is an issue considered in the SDGs?
- Are students able to give examples of invasive plant species?
- Which factors influence invasive plants mental models of students?
- Is conceptual change observed?

In addition, it is necessary to study the extent of the students' procedural and attitudinal knowledge.

- Are students able to communicate ideas and opinions in relation to environmental issues of social relevance?
- Are students able to specify some relationships and interactions between social and natural components in their close environment?
- Is causal reasoning present in their explanations?
- Are students able to use some specific scientific vocabulary related to this issue?
- Are students aware of the importance of scientific language from early ages?
- Do they understand the role of the teachers in promoting scientific language from early ages?
- Are students able to design classroom proposals accordingly

IV. RESEARCH DESIGN AND METHODOLOGY

Qualitative results of a case study are presented in this work. Objectives and issues to be covered by the case study are clearly defined in the previous section. Teachers in training were

III. KEY OBJECTIVES

Various objectives and questions emerge in this study. It aims to evaluate specific environmental competencies of teachers in training, due to the importance of the scientific literacy of future teachers

considered a study population of interest to meet these research objectives. The study was conducted with 44 students undertaking a degree in Primary Education Teaching enrolled on the Didactic of Biological and Geological Environment course from February to May 2019. Initial hypotheses in relation to raised questions were:

- Most of the students know what SDGs are. However, students may not know that the proliferation of invasive plant species is an issue considered in the Sustainable Development Goals.
- The examples of common invasive plant species cited by students are influenced by students' local environment, the news and their experiences.
- Students have a simplistic mental model of invasive species which is also influenced by local environment, the news and their experiences.
- Students are able to communicate ideas and opinions, but it is difficult for them to identify cause-effect relationships between social and natural components in their local environment and it is difficult for them to use specific vocabulary related to this issue.
- Students are aware of the importance of scientific language from early ages, and they are conscious of their role in promoting scientific language as teachers. Nevertheless, they feel that their training does not sufficiently prepare them to carry out this function in their future careers.
- Students will improve their environmental competences by the implementation of the intervention proposal. Conceptual, procedural and attitudinal change will be observed. Collaborative work to design written classroom proposals will help facilitate these changes.

Data was collected in different sessions, by means of written and oral data sources:

- Individual initial questionnaire, adapted from the work of García de Lomas, et al. (2014).
- Debate and brainstorming sessions to discuss concepts and examples of autochthonous, native, and invasive species.



- Collaborative classroom sessions to:
 - o Work physically with live invasive plants in the classroom
 - o Design classroom proposals with a scientific/social use, to explore causes and consequences of potential invasive species proliferation in primary school classrooms (in small groups of 2-3 people). Students have to consider biological characteristics of vegetal species and the magnitude of the impacts they can cause.

stages and it must also be in the training of future teachers (Benarroch & Marin, 2011; Liefländer et al., 2013; Ruiz, Márquez & Tamayo, 2014). It is worth noting that a significant number of students neither know any examples of invasive species nor any example of native species. Noteworthy examples given (pine tree and orange tree) confirm

V. FINDINGS AND DISCUSSION

Collected data revealed that students do not know what SDGs are even though it is considered a fundamental transversal content. This also means students are not aware that the proliferation of invasive species is an issue considered in SDGs. As environmental education is a priority knowledge area to be promoted at compulsory educational

the influence of the local environment and origin of the students in the native species indicated. An unexpectedly high percentage of students included scientific names in their examples. Explanations include scientific and everyday vocabulary (Rodríguez, 2004). A summary of examples of native and invasive plant species given by students and percentages that represents within the total of given examples are included in Figure 1

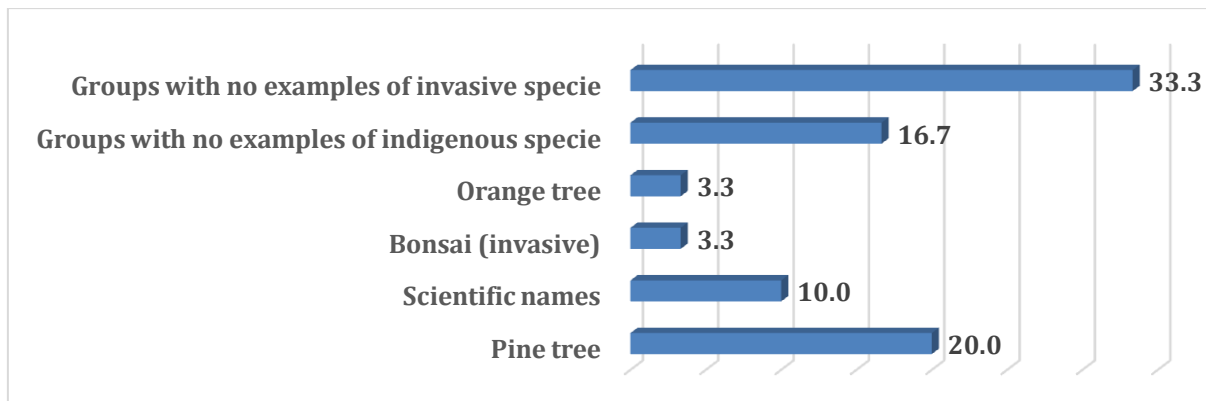


FIGURE 1. EXAMPLES OF NATIVE AND INVASIVE SPECIES

Students have a simple mental model of invasive species, and they have problems to construct and explain biology concepts (Rodríguez, 2004), associated with language problems. More complex conceptual models are needed to develop an integrated vision of the environmental systems dynamic (Arana, 2007) taking into account relationships and interactions occurring between the social and natural components. These are of great relevance in the construction of the scientific concepts. For instance, the evolutionary processes through which the diversity of life forms that exist on Earth originated. Invasive plants are a typical example of rapid evolution. Autochthonous,

evolution, hybridization, or adaptation are interesting concepts to work with (Caires et al., 2015) together with other concepts such as migrations or political boundaries. Data shows that the meaning of autochthonous is broad and confusing for students. The concept of adaptation and hybridisation as a genetic combination is not fully recognised by students even if they have a vague idea about how it affects the external physical characteristics of plants. The functionalities of flowers or fruits and seeds are considered by some for example. Figure 2 shows percentages that represents different meanings and interpretations given to the autochthonous concept.

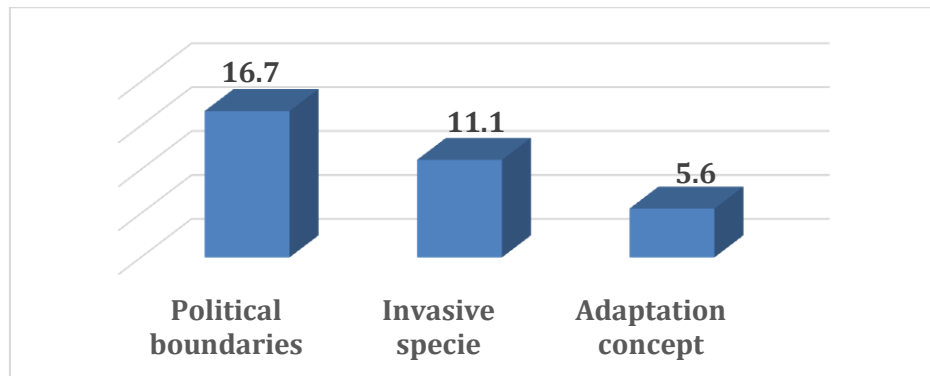


FIGURE 2. INTERPRETATIONS GIVEN BY STUDENTS TO THE CONCEPT OF AUTOCHTHONOUS
(% compared to the total).

The current prevalence in the use of gestures or emoticons to represent concepts or moods is revealing. It is possible that the power and ease in their usage diminish the ability to verbalize these situations or concepts through words as was already argued by Bernete (2007) and Vaqueiro (2015). Almost all students consider that invasive plants damage native grassland ecology and threaten already vulnerable populations. On the other hand, invasive plants can bring some environmental benefits such as the restoration of degraded ecosystems due to their ability to grow in almost any condition. Citizens and professionals should possess environmental education knowledge regarding invasive plant management as well as teachers (Ma, Clarke and Church, 2018; Rodrigues, 2015; Verloove, 2010).

Students are aware of the importance of scientific language from early ages, and they are conscious of their role as teachers in this, as

expected; 30% state that they are willing to train and 11% explain that their previous training has been excessively memoristic.

Designing their own intervention proposals contributed to students improving their environmental competences. They confirmed that they have acquired competencies in the studied subject. A positive influence of collaborative, problem-based inquiry in scientific reasoning was corroborated. This suggests it is necessary to promote the use of active methodologies (Gustavsson et al, 2016). They allow students to build their learning applying reasoning across all subjects fostering dialogue between equals with the guidance of the teacher. According to the formative approach in the teaching of biology, teachers must promote activities which are learner-centred and aimed at maintaining continuous dialogue between learners with an emphasis on learning from feedback and contextualisation (Polo and Malagón, 2015).

VI. CONCLUSION

This study analysed the discourse of teachers in training regarding an issue of social relevance which was also considered of interest to them, namely, the proliferation of invasive plant species and its consequences in the context of SDGs pursued by the United Nations. It is of vital importance to pay attention to the supporting role that early ages education can perform in sustainable development and in the training of children (Davis, 2009). This encourages the acceptance and care of the environment, oneself and the other as well as a sense of belonging in the environment in which

they live. Several studies concluded that active methodologies help children to develop constructive and sustainable ecological skills (Mileto et al., 2017). All this is of vital importance and obliges the entire educational community especially the family, as has been shown by various authors (Weigel et al., 2006; Anderson et al., 2010; Swain & Cara, 2017), to transfer the schools' ways of teaching into the home and beyond influencing behaviours, beliefs, understanding, activities and practices.



Students confirmed that they acquired competencies thanks to the positive influence of collaborative, contextualised problem-based inquiry tools to build their learning applying reasoning and fostering dialogue between. It will be necessary for students to address the teaching of scientific content concerning social needs and to debate and make decisions regarding the sustainability of the planet in the future. The integration of knowledge to develop environmental competences in the teaching-learning process in an interdisciplinary way is effective in the development of knowledge, skills and evaluation in students (Ruiz et al., 2014). Evidence shows that a scientific understanding of causal relationships can be applied flexibly and creatively to a diverse range of situations. (Santiuste, 2017). Understanding biology, language and education as basic elements in a new scientific pedagogy or science of education is an old discipline that needs a scientific foundation to compensate for its conception as a mere applied science (Quintana, 2018). Reflection, socialising and research activities encourage participation and favour formative assessment of sciences by generating a space for independent learning (Torres et al., 2017; Zee et al., 2005). Students structure scientific discourse and improve their knowledge of the dynamics of biological systems. A lack of motivation among students is often considered by biology teachers as a cause of school failure (Borges, Guimarães and de Almeida, 2018). Therefore it is crucial that scientific didactic models enhance student participation and make relationships between students and teacher more horizontal fundamentally facilitating students' understanding of biological concepts (Gustavsson et al, 2016; Gómez et al., 2019).

ACKNOWLEDGEMENTS

The authors would like to thank students and colleges who made possible the collection of data to carry out the study and also to the Beagle research group (S27_20R) and the IUCA Research Institute, both of the University of Zaragoza. The authors thank to the reviewers all suggestions which significantly increase the quality of the manuscript. This work was supported by the Projects PID2019-105320RB-I00 financed by MCIN/AEI/ 10.13039/501100011033; MINECO EDU2016-76743-P project; CIENCIATE3-2018/B001; CIENCIATE4-2020-B002; PIIDUZ_19_525 and PIIDUZ_1_231_2021.

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