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Article

Botanical education for vocational training students and primary and secondary teacher

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Abstract: A domain of practical learning over the theoretical is provided in this work, for this several places of natural interest have been studied (Natural Parks), a quality pedagogical training is obtained, through which the students of Vocational Training and Primary and Secondary Education Teachers obtain competences in the management of natural spaces, which are of interest for conservation, competences in flora, plant communities, habitats and interpretation of the landscape. The learning is eminently practical, which allows trained personnel to enter the labor market. The study of natural spaces has been carried out using direct observation techniques, with the participation of specialist teachers in various fields, because the interpretation of vegetation, habitats and landscape requires multidisciplinary techniques. For this, teaching methodologies in Botany are used, how have the phytosociological sampling techniques been; Geology, Edaphology, and Climatology, in the latter case creating future predictive models that allow the student to make decisions about the management of a territory; this study has made it possible to carry out a comprehensive interpretation of the natural environment, with a notable pedagogical improvement in learning.

Keywords: Field practices; Botany; Vocational training; Acquisition skills

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1. Introduction

The contents for teachers of Primary, Secondary Education and Professional Training on Management and Conservation of Biodiversity, must be oriented, so that students acquire the bases of the scientific culture, and must be eminently practical of a cognitive and psychomotor nature [1, 2], since the training of these students allows their inclusion in the labor market, being these responsible for the management of protected natural areas and / or teaching students of Primary and Secondary Education, students who in the future could act as forest guards of said natural spaces.

To achieve this objective, the training of teachers and specialized personnel is necessary, which enhances the professional vision of future teachers and managers of the natural environment [3-5]. For this it is necessary for the teacher to carry out a translation of the scientific language, which will allow a better understanding of nature to future teachers and specialists in the management of natural spaces [6].

In Vocational Training Education, various aspects are addressed: physical-chemical, botanical-geological, floristic, habitats, landscape and anthropic in nature, aspects that must be fundamentally practical in nature: for this knowledge about natural sciences must be consolidated and expanded by incorporating practical activities, adapting the contents to the social and environmental reality of the moment. Therefore, at this time it is essential to include various environmental aspects in the content, such as the pollution of land, water, fires, climate change, protection of flora, habitat and landscape.

Aspects of a physical nature, such as abiotic factors, which will be treated previously when explaining the physical-chemical factors; as the teaching of Botany has a multidisciplinary nature, this requires prior planning, with a series of organized activities.

1. Climatic analysis, in which the concept of anticyclones and storms is taught, and the difference between precipitation (rain) and pluviometry (measure of precipitation).
2. Study of the geomorphology or modeling of the terrain, for which the mountain systems are previously studied, this being the moment in which it can be shown how the temperature drops for every 100 m. of altitude.
3. Study of the soil, for which it is necessary that the student understands what the soil profile is, measuring its power through a practical field activity, and differentiating between acid and basic soils, which is achieved with a simple experiment, adding acid to the soil, which can be simply acetic acid: with this the student will see how the carbonate decomposes and CO_2 is released.
4. This first phase of the teaching ends by clarifying what is natural and introduced vegetation, what is due to the action of man (anthropic action).

From this first phase of teaching, the student can understand bioclimatic and biogeographical concepts, as well as plant dynamics and the concept of vegetation series.

It is evident that field observations in which different types of knowledge are intertwined, require an inter multidisciplinary treatment [7,8], which improves the pedagogical aspects of this teaching. For this, teachers from different specialties have intervened in the field practices, botanists, geologists, soil scientists and climatologists who relate climate change with predictive models of vegetation [9]. This will allow the student to a) adopt critical attitudes based on knowledge to analyze, individually or in groups, scientific and technological issues, b) develop favorable attitudes and habits in respect for the environment; c) understand the importance of using the knowledge of the natural sciences to satisfy human needs and participate in the necessary decision-making around local and global problems that we face, and d) acquire skills in the management of Biodiversity [10].

Knowing and enhancing the interactions of science and technology with society and the environment, with particular attention to the problems that humanity must face today and to the need to seek and apply solutions, in compliance with the precautionary principle, is fundamental to advance towards a sustainable future [11]. Furthermore, it is important to recognize the experimental and creative nature of the natural sciences, as well as their contribution to human thought throughout history, appreciating the great debates on the overcoming of dogmatisms and the scientific revolutions that have marked the cultural evolution of humanity and his living conditions.

Natural capital is the most important factor in achieving sustainability [12]. In response to the need for educational training, in order to obtain future managers in sustainability, it is necessary to train people who can sustainably manage ecosystems, being necessary the acquisition of theoretical-practical knowledge of a floristic and phytosociological nature, which implies geobotanical studies, bioclimatic, biogeographic, anthropic [13,14].

Although the knowledge of the species has been and continues to be fundamental for the further development of Phytosociology, no less important is the strong advance, which, from the hand of Professor Rivas Martínez, has had Bioclimatology as an essential basis in the description of the phytocoenoses, as well as in agricultural, forestry and livestock planning [15-20].

Bioclimatology is an ecological science, which has gained importance in recent years and which tries to highlight the relationship between living beings (Biology) and the climate (Physics) [21]. It differs from Climatology in that the information, indices and units it uses are related and delimited by species and phytocoenoses (biocenosis). The development of Bioclimatology as a basic discipline at the service of Geobotany has been one of the most outstanding scientific aspects in recent times; the progress of this science has made it possible to better diagnose many plant communities, and above all to be able to better specify the altitudinal cliseries.

For the study of Geobotany and for agricultural, livestock and forestry planning, it is important to know the bioclimatic and biogeographic aspects, this last analysis is essential, to place the study in specific areas, in this case we are located in Andalusia, with the provinces biogeographic Bética, Murciano-Almeriense, Lusitano-Andalusian-Litoral and Mediterranean Iberian Western [18] (Figure 1).

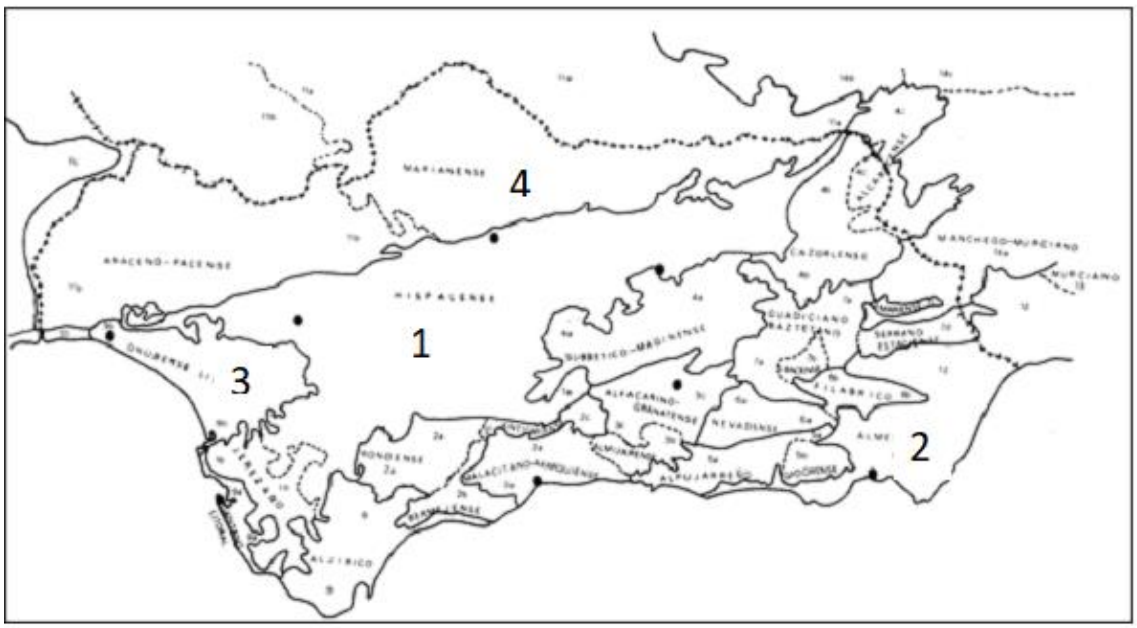

Figure 1. Biogeography of the southern Iberian Peninsula (Andalusia). Biogeographic provinces 1.- Betica. 2.- Murciano-Almeriense. 3.- Lusitano-Andalusian-Litoral and 4.- Western Iberian Mediterranean Taken and adapted from Rivas-Martínez et al. [35].

Of the different factors that lead to the existence of some plant ecosystems, precipitation and temperature are among the most important. Thus, each region or group of biogeographic regions has a peculiar altitudinal zoning of plant ecosystems; such cliseries or concatenated series, is due to the progressive decrease of the annual mean temperature with the altitude (thermoclimate).

If the climate (temperature and precipitation) is correlated with the biocenotic discontinuities that appear in the mountains with altitude (altitudinal cliseries), we will see that certain rhythms or changes as a function of temperature and precipitation (thermoclimate and ombroclimate). Consequently, based on such changes, it is possible to recognize, on the one hand, the physical continent, which are the bioclimatic belts, and on the other, the plant biological content, which are the vegetation series.

The main goal of this study is the training of specialized personnel in the field of Primary and Secondary Education Teachers and Vocational Training. Although at this moment there are enough biologists and ecologists with university studies, there is a demand for people trained in flora, vegetation, habitats: specialists who will transmit to the students ecological values for conservation, and trained people who occupy the works of the Forest Nursery and the Civil Guard (SEPRONA), the latter being the personnel in charge of the surveillance and security of the different protected natural areas (Natural Places, Natural Parks, National Parks, Biosphere Reserves) and in general Sites of Community Interest.

2. Materials and Methods

From the methodological point of view, it is important that the student learns the different techniques of vegetation sampling. Having to obtain an observation capacity to act autonomously, for this the development of their cognitive capacities is necessary.

In order to assimilate the phytosociological sampling method for the student, and obtain a development of his cognitive and psychomotrical qualities, we previously plan in the classroom a theoretical study of a precise sampling methodology, and later we program a set of field and laboratory activities, which allow the theoretical knowledge acquired to be put into practice.[36]

The phytosociological method consists of two phases, the first of an analytical nature is of great importance, since the selection of the sampling plots must be done in a meticulous way, the second phase is of a synthetic type. With this method, homogeneous plots are selected and the total coverage of the phytocoenoses is taken. The degree of coverage is given in % and represents the land area covered with vegetation. To calculate the percentage of coverage, the sampled plot is measured, which will have a variable value depending on the type of phytocoenoses, the biome in which the plant community is integrated, for example in Mediterranean areas the sampling area for forests usually oscillates between 300- 500 m^2, while in tropical and subtropical zones this area should be increased to 1000-2000 m^2, for scrub communities between 50-200 m^2 are taken, grasslands between 0.5-2 m^2. In all cases it is convenient perform the calculation of the minimum area to obtain the maximum floristic diversity in the minimum surface area. If a plot has 100 m^2 and there are 45 m^2 covered, it means that the degree of coverage is 45%. Next, an enumeration of the number of species is made and the total number of species is extracted (global estimate), this global estimate being an indicator factor of biodiversity. Each species is given an abundance-dominance index, which indicates the number of individuals of a certain species, these indices are: +, 1, 2, 3, 4, 5. + indicates a rare individual in the selected plot, this Index is given when 1 or 2 feet of plant appear. 1 indicates very scarce individuals, this index is given when there are some isolated plant feet. 2 indicates that they are rare individuals. 3 little abundant, but in this case the plant already covers part of the ground. 4 abundant plant. 5 very abundant plant. The indices from + to 2 present a small degree of coverage of less than 50%, 3 should correspond to coverage that ranges between 55-75%, 4 with 75-90% and 5 of 90-100%. Considering the vegetation sampling method established by various researchers [22-25]; collected by us in several works [26-30], the concept

of plant association, habitat and a precise methodology on the study of the landscape are obtained.

The practical field and laboratory study of the above, consists in establishing the size of the plot: for this the student in principle learns to differentiate forests from scrubs and grasslands, and later their types, in parallel in the field a correlation is established between the type of plant community, the power of soil and type, together with the climatic character of the territory, in this way the student connects the biotic with the abiotic.

Regarding the learning of the floristic composition of the types of plant communities, the dominant plants are herborized and analyzed in the laboratory, the students learn to orient themselves, measuring the orientation of the sampling plot, the inclination, the cover and the minimum height, maximum and average of the dominant species.

From the completion of these activities, the field study site is framed in a specific bioclimate and biogeographical unit. For these activities, 42 field hours are scheduled in the spring, which represents 70% of the 60 hours of total teaching.

3. Results and Discussion

The study of the flora and vegetation of some Natural Spaces reveals the presence of botanical-ecological values of interest for conservation, values that students of Teachers and Professional Training must know, for this a domain of practical learning over the theoretical, with an approximate percentage of 70% practical and 30% theoretical.

When the student has acquired a minimum theoretical floristic knowledge, and on the concepts of association, plant dynamics, habitats, landscape units, bioclimatology and biogeography; it goes on to practical field teaching. We analyze some natural areas in the south of the Iberian Peninsula, Cabo of Gata, Cazorla-Segura and Las Villas.

In this study the student herbalizes botanical species that he learns to determine in the laboratory, although the study of the species of botanical interest is carried out in situ, taking into account the respect for their conservation, as is the case of *Viola cazorlensis* Gand. (Figure 2) endemic species from the Natural Parks of Cazorla, Segura Las villas and Magina.

Figure 2. *Viola cazorlensis* Gand., endemic species of the Natural Parks of Cazorla, Segura, Las Villas and Mágina.

In the case of the Cazorla, Segura and Las Villas Natural Park, for such emblematic locations as the Cerrada del Utrero, up to 10 types of plant associations are detected in the study, with different spatial extension, which allows establishing two large groups of plant associations (macro and microassociations) (Figure 3), the bushes and forests belong to the macroassociations: 1 (willow trees), 4 (bojedas), 9 (cornicabrales), 10 (holm oaks), the rest (2,3,5,6, 7 and 8) are micro-associations that occupy small areas, but of relevance because they present rare, scarce and / or endemic species. To know the diversity of plant communities or associations, phytosociological field surveys are carried out, which allows the student to understand the territorial diversity, the type of plant species present and the value they present.

Attending to the planned theoretical and practical activities, in Cazorla-Segura-Las Villas the following plant diversity is obtained.

1. Forests dominated by species of the Fagaceae family; oak forests of *Quercus rotundifolia*, "quejigares" of *Quercus faginea*.
2. Coniferous forests dominated by *Pinus halepensis* or *Pinus mauritanica*.
3. Bushes 2-4 meters high, of strawberry trees, *Arbutus unedo*, Kermes oak, *Quercus coccifera* and in specific areas juniper bushes *Juniperus oxycedrus* or *Juniperus phoenicea*, compared to low-sized bushes when exploiting soils of lesser potency than the previous ones, rose bushes and gorse; being skeletal, calcareous or dolomitic soils, being in the latter where the endemism *Viola cazorlensis* is located.

In these learning activities, when studying the different plant communities and their floristic composition, two types of phytocoenoses have been obtained that have a different space-time character: they are the macro-associations that occupy a wide territorial and distribution area, associations that are permanent in time; and the micro-associations that occupy small areas or stands, and that in some cases may have an annual character.

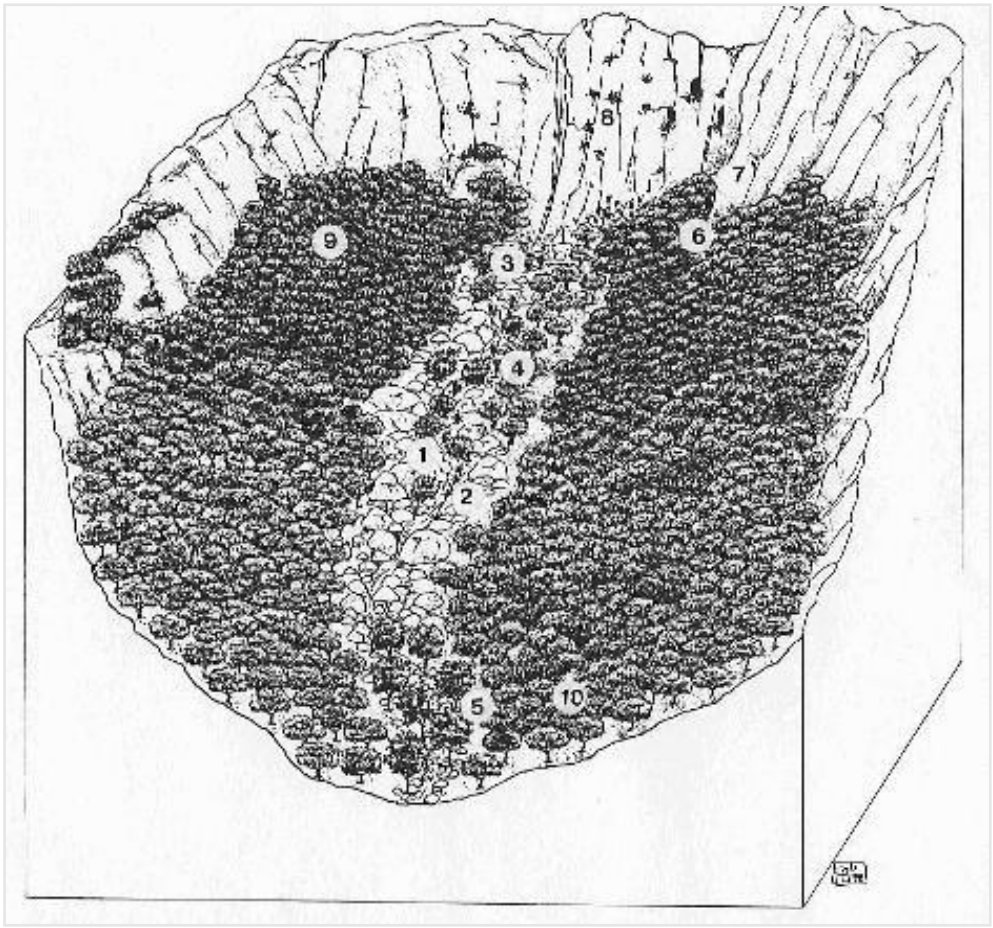

Figure 3. 1, 4, 9 and 10: plant associations that occupy a large space (macro-associations). 2, 3, 5, 6, 7 and 8: associations that occupy small areas (micro-associations).

For the study of plant communities, the phytosociological method is applied [18-19], differentiating between forests, bushes, rock communities, aquatic, grasslands. This study in Cabo de Gata (Almería) reveals the presence of tropical floristic elements, which form plant communities of high conservation value (Figures 4 and 5), being of special relevance the plant communities of *Periploca laevigata* Aiton, *Ziziphus lotus* (L.) Lam., and *Gymnosporia senegalensis* (Lam.) Loes. [syn.: *Maytenus senegalensis* (Lam.) Exell], which constitute special habitats prioritized by the EU, as well as aquatic and wetland plant communities that usually constitute plant micro-associations, occupying small areas [31-33].

Due to the specific semi-arid, arid character of Cabo de Gata, and the lack of frost in those areas facing the sea (orientation east, southeast, revealed in phytosociological inventories), areas influenced by the seas, the study carried out by the students from this area shows a high botanical-ecological value, due to the presence of emblematic species, arrivals in these areas on past migratory routes.

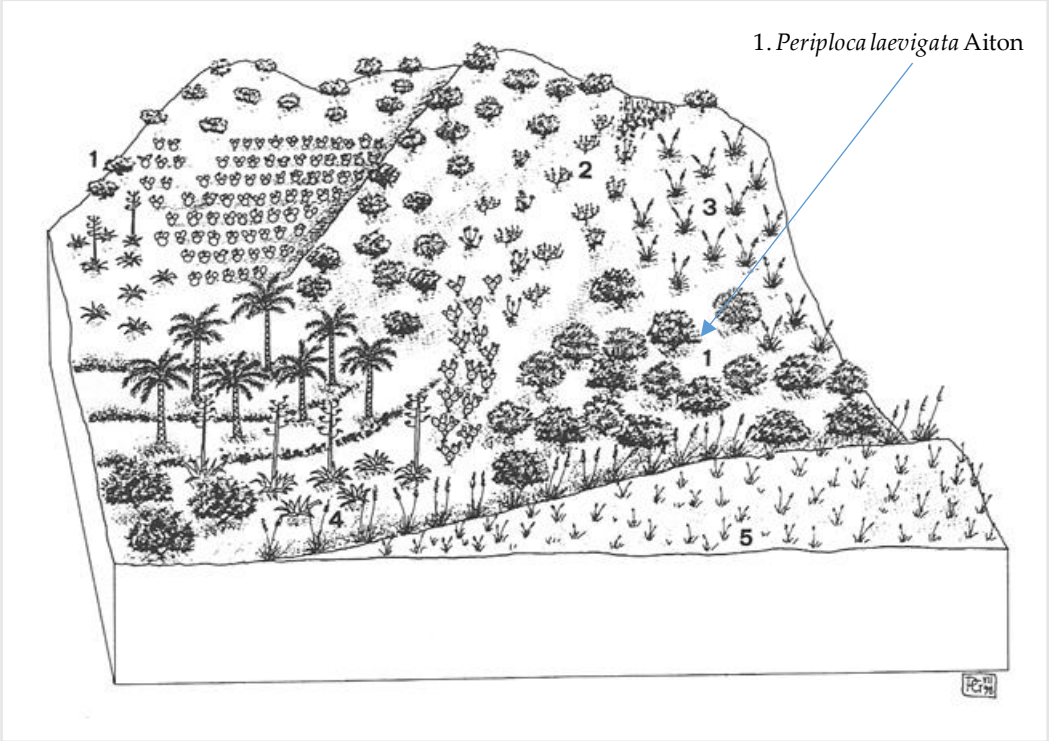

Figure 4. Cabo de Gata Natural Park. 1: Communities of *Periploca laevigata* Aiton. 2 and 3: Endemic tomillares. 4: Esparto community. Taken and adapted from Mota et al. [34].

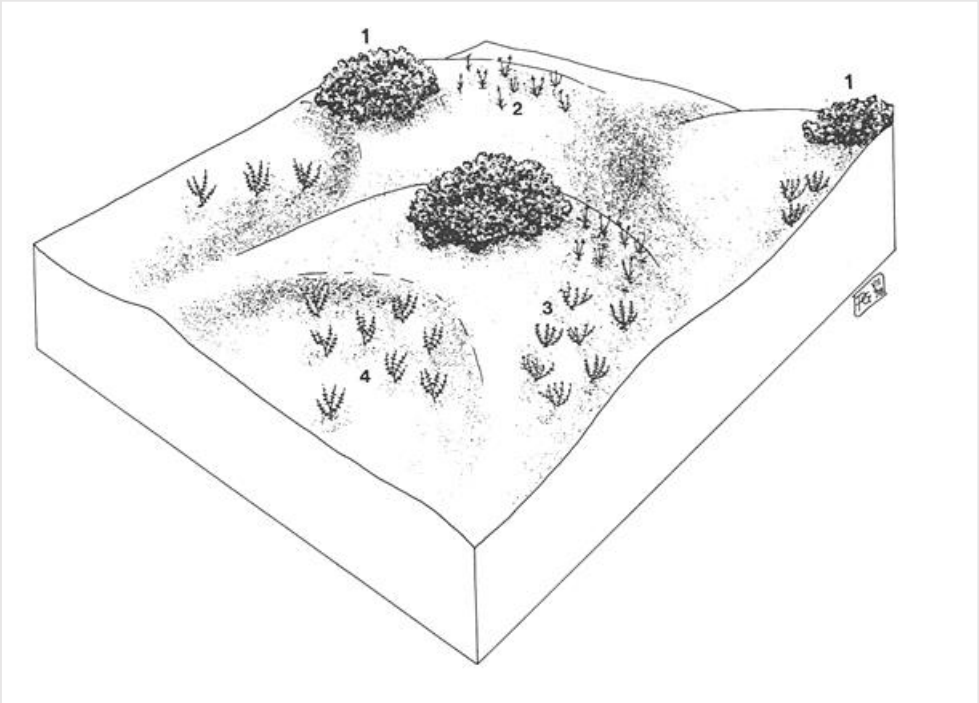

Figure 5. 1: *Ziziphus lotus* communities. 2: Tomillar on sand. Taken and adapted from Mota et al. [34].

5. Conclusions

According to the established work methodology, and the results obtained with the planned field activities, it has been possible to highlight the high botanical-ecological

value of two areas exceptionally rich in diversity (Cazorla-Segura-Las Villas; Cabo de Gata), both presenting a high rate of habitats of community interest, with which the student has been trained in the use of a precise methodology for the knowledge of habitats, by experimenting and connecting abiotic factors with biotic ones; sequencing a series of scheduled theoretical-practical activities, in which, starting from the physical-chemical processes, connected with bioclimatology, biogeography and existing vegetation in the area, and through floristics, the analysis of the diversity and assess the state of conservation of habitats. Presenting greater value the tropicaloid communities of Cabo de Gata and those of *Viola cazorlensis* of the Cazorla-Segura-Las Villas Natural Park.

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References

[1] Bloom, B.; Englehart, M.; Furst, E.; Hill, W.; Krathwohl, D. *Taxonomy of educational objectives: The classification of educational goals. Handbook I: Cognitive domain.* New York, Toronto: Longmans, Green, 1956.

[2] Fernández, I. M.; Pires, D. M.; Villamañán, R. M. Educación científica con enfoque ciencia-tecnología-sociedad-ambiente: construcción de un instrumento de análisis de las directrices curriculares. *Formación Universitaria*. 2014, *7*(5), 23-32. http://dx.doi.org/10.4067/S0718-50062014000500004.

[3] Laveria Hutchison, L.; McAlister-Shields, L. Culturally Responsive Teaching: Its Application inHigher Education Environments. *Educ. Sci.* 2020, *10*, 124; doi:10.3390/educsci10050124.

[4] Villardón-Gallego, L.; Flores-Moncada, L.; Yáñez-Marquina, L.; García-Montero; R. Best Practices in the Development of Transversal Competences among Youths in Vulnerable Situations. *Educ. Sci.* 2020, *10*, 230; doi:10.3390/educsci10090230.

[5] Friederike Vogt, F.; Schmiemann, P. Assessing Biology Pre-Service Teachers' Professional Vision of Teaching Scientific Inquiry. *Educ. Sci.* 2020, *10*, 332; doi:10.3390/educsci10110332.

[6] Koponen, I.T. Usage of Terms "Science" and "Scientific Knowledge" in Nature of Science (NOS): Do Their Lexicons in Different Accounts Indicate Shared Conceptions? *Educ. Sci.* 2020, *10*, 252; doi:10.3390/educsci10090252

[7] Miranda, J.P.; Batista, M.; Duarte, C.; Sanches, T. Interdisciplinary Class Observation in Higher Education: Lessons Learned from the Professional Development Experience of Four Teachers. *Educ. Sci.* 2021, *11*, 706. https://doi.org/educsci11110706

[8] Tovar-Gálvez, J.C. Design of Intercultural Teaching Practices for Science Education based on evidence. *Enseñanza de las Ciencias*. 2021, *39-1*, 99-115. https://doi.org/10.5565/rev/ensciencias.2891

[9] Bello Benavides, L.O.; Cruz Sánchez, G.E.; Meira Cartera, P.A.; González Gaudiano, E. El cambio climático en el bachillerato. Aportes pedagógicos para su abordaje. *Enseñanza de las Ciencias*. 2021, *39-1*, 137-156. https//doi.org/10.5565/rev/ensciencias.3030

[10] Ramaphakela, J.; Mdhlalose, D. Examination of the Creation of a Positive Culture of Teaching and Learning through Classroom Management. *Open Journal of Educational Research*, 2021, *1*(1), 32–40.

[11] Mormina, M. Science, Technology and Innovation as Social Goods for Development: Rethinking Research Capacity Building from Sen's Capabilities Approach. *Sci Eng Ethics* 2019, *25*, 671–692. https://doi.org/10.1007/s11948-018-0037-1

[12] Norouzi, N.; Fani, M. Comparison of Weak and Strong Theories of Environmental Sustainability in the Conceptual Context of Sustainable Development. *Research Journal of Ecology and Environmental Sciences* 2021, *1*(2), 108–122.

[13] Cañas, A.; Martín-Díaz, M.; Nieda, J. *Competencia en el conocimiento y la interacción en el mundo físico. La competencia científica*. Madrid. Alianza Editorial. 2007.

[14] García Barros, S.; Martínez Losada, C.; Rivadulla López, J. Actividades de textos excolares. Su contribución al desarrollo de la competencia científica. *Enseñanza de las Ciencias*. 2021, *39-1*, 219-238. https//doi.org/10.5565/rev/ensciencias.3099.

[15] Rivas-Martínez S.; Loidi Arregui J. Bioclimatoloy of theIberianPeninsula. *Itinera Geobotanica*. 1999, *13*, 41-47.

[16] Rivas-Martínez, S.; Díaz, T. E.; Fernández-González, F.; Izco, J.; Loidi, J.; Lousa, M; Penas, A. Vascular Plant Communities of Spain and Portugal. *Itinera Geobotanica*. 2002a, 15(1), 5-432.

[17] Rivas-Martínez, S.; Díaz, T. E.; Fernández-González, F., Izco, J., Loidi, J., Lousa, M.; Penas A. Vascular Plant Communities of Spain and Portugal. *Itinera Geobotanica*. 2002b, 15(2), 433-922.

[18] Rivas-Martínez, S. Mapa de series, geoseries y geopermaseries de vegetación de España. Parte I. *Itinera Geobotanica*. 2007, 17, 5-436.
[19] Rivas-Martínez, S. and co-authors. Mapa de series, geoseries y geopermaseries de vegetación de España. Parte II. *Itinera Geobotanica*. 2011, 18(2), 425-800.
[20] Perrino, E.V.; Musarella, C.M.; Magazzini, P. Management of grazing Italian river buffalo to preserve habitats defined by Directive 92/43/EEC in a protected wetland area on the Mediterranean coast: Palude Frattarolo, Apulia, Italy. *Euro-Mediterr. J Environ. Integr.* 2021, *6*, 32. https://doi.org/10.1007/s41207-020-00235-2
[21] Munn, R.E. Bioclimatology. In: Climatology. Encyclopedia of Earth Science. Springer, Boston, MA. 1987 https://doi.org/10.1007/0-387-30749-4_26
[22] Braun-Blanquet, J. *Fitosociología*, Ed. Blume, Madrid. 1979
[23] Gehú, J.M.; Rivas Martínez, S. Notions fondamentales de Phytosociologie. Syntaxonomie. J.Cramer. Vadeuz. 1981.
[24] Gehú, J.M. Des complexes de gropupements végétaux à la phytosociologie paysagère contemporaine. *Inf. Bot. Ital*. 1987, 18, 53-83.
[25] Rivas Martínez, S. *Memoria del mapa de series de vegetación de España 1:400.000.* Ministerio de Agricultura, Pesca y Alimentación. I.C.O.N.A. Madrid. 1987.
[26] Cano Ortiz, A.; Piñar Fuentes, J.C.; Cano, E. Didactics of Natural Sciences in Higher Scondary Education. *IJHSSE*. 2021a, 8(9), 1-5. https://doi.org/10.20431/2349.0809001
[27] Cano Ortiz, A.; Piñar Fuentes, J.C.; Ighbareyeh, J.M.H.; Quinto Canas, R.; Cano, E. Didactic Aspects in the Teaching of Vegetation in Secondary andHigh School Education. *IJHSSE.* 2021b, 8(6), 1-7. https://doi.org/10.20431/2349-0381.0806002
[28] Cano Ortiz, A.; Piñar Fuentes, J.C.; Cano, E. *The use of technology for the teaching of foliar structures*. V International virtual conference on educational research and innovation- CIVINEDU, Spain, 2021c
[29] Cano Ortiz, A.; Piñar Fuentes, J.C.; Cano, E. *Proposals for the learning of plant diversity.* V International virtual conference on educational research and innovation – CIVINEDU, Spain, 2021d.
[30] Cano Ortiz, A; Cano, E. *On the virtual teaching of plant species and communities in High School and University Education*. VI Virtual International Conference on Education, Innovation and ICT- EDUNOVATIC, Spain, 2021.
[31] Cano, E. *Análisis del paisaje vegetal de la provincia de Jaén.* Discurso de Ingreso en el Instituto de Estudios Giennenses, Diputación Provincial de Jaén 2007, Spain.
[32] Mendoza-Fernández, A.J.; Salmerón-Sánchez, E.; Martínez-Hernández, F.; Pérez-García, F.J.; Lahora, A.; Merlo, E.; Mota, J.F. Intensive Habitat Loss in South Spain: Arborescent Scrubs with *Ziziphus* (5220*). In *Habitats of the World-Biodiversity and Threats*; Musarella, C.M., Cano Ortiz, A., Quinto Canas, R., Eds.; IntechOpen: London, UK, 2019. DOI: 10.5772/intechopen.85286
[33] Mendoza-Fernández, A.J.; Martínez-Hernández, F.; Salmerón-Sánchez, E.; Pérez-García, F.J.; Teruel, B.; Merlo, M.E.; Mota, J.F. The Relict Ecosystem of *Maytenus senegalensis* subsp. *europaea* in an Agricultural Landscape: Past, Present and Future Scenarios. *Land* 2021, *10*, 1. https://doi.org/10.3390/land10010001
[34] Mota, J.F., Cabello Pinar, J., Cueto Romero, M., Gómez Mercado, F., Jiménez Luque, E., Peñas de Giles, J. Datos sobre la vegetación del sureste de Almería: Desierto de Tabernas, Karst en Yesos de Sorbas y Cabo de Gata. Departamento de Biología Vegetal, Producción Vegetal y Ecología. Universidad de Almería. Almería. 1997
[35] Rivas Martínez, s., Asensi, A., Díez-Garretas, B., Molero, J., Valle, F. Biogeographical síntesis of Andalucia (Sothern Spain). *Journal of Biogeography*. 1997, 24, 915-928.
[36] Friederike Vogt, F.; Schmiemann, P. Assessing Biology Pre-Service Teachers' Professional Vision of Teaching Scientific Inquiry. Educ. Sci. 2020, 10, 332; doi:10.3390/educsci10110332.