Methodological development for teaching environmental management within the framework of the university research and teaching project in the Central of Heredia (March to September 2020), Costa Rica. A preliminary study

R Durán Sosa¹ and R Alexandre Castanho²³

¹School of Administration, Faculty of Social Sciences, National University-Costa Rica.
²Faculty of Applied Sciences, WSB University 41-300 Dabrowa Górnicza, Poland
³College of Business and Economics, University of Johannesburg PO Box 524, Auckland Park, South Africa

Abstract. In January 2020, the “Urban and social reconfiguration project of Heredia, and youth population, 1985-2020” starts its operations. Its objective is to analyze the urban capacities for social life, and the imprint of young people has developed between 1985 to 2020 in Heredia. Thus, to achieve the proposed goals, a methodology is established that joins research and teaching areas. Consequences of institutional policies impact this methodology to come from a national emergency of Covid-19, which causes the substantial methodological changes of the project. This preliminary study aims to communicate the methodological challenges in teaching environmental management in the current context. The method is interviews applied to students and academics participating in the project, consultation of secondary sources, records, databases, institutional reports, and observation of areas representing a less epidemiological risk to researchers. The conclusions of this experience are the following: (i) changes in the techniques of the methods and tools used in science; (ii) resilience of academic staff to take on extra hours; development of new learning technologies; and (iii) approach to the pedagogical discussion related to the project in the current conditions, which it makes a solid and enriching panorama for academic issues.

Keywords: Academic, administrations, learning, methods, research.

1. Introduction
University history has shown that interdisciplinary work is one of the pillars for the development of science and the participation of students in this model. This training model is based on the strategic plan of the Faculty of Social Sciences (FCS) for the period 2013-2017 [1], which establishes as a strategic area of knowledge: the Environment, territory, and sustainability, giving way to the substantive action of the areas of knowledge between the FCS and the geographical sciences. In this line, an interdisciplinary and integrated project is born, in which the Schools of History, Geographical Sciences, and Administration participate. All of them share the study area, which is the metropolitan area of Heredia. This territory is considered in scientific research to analyse the socio-spatial and environmental reconfiguration of the central Canton of Heredia to typify the transformations of the urban space that affect youth's neighbourhood social networks during that period [2].
1.1. Characteristics of the project study area

A central axis that unites the joint work of the academic units participating in the project is knowledge about human intervention in the territory. One aspect of this intervention is the transformation of the rural to urban areas, which leaves a mark on natural resources at different times. Currently, this territory is occupied by communities whose urban growth is characterized by the lack of a land-use planning policy and squalid regulations. In the field inspections in the highlands, it is observed that the wastewater from some towns goes directly to the rivers and streams, without any previous treatment, which contributes to their contamination. Urban pressure and economic activity stimulated the forest landscape change to make way for the pressure of natural resources such as soil. The lack of a territorial approach suggests opposing forces from the political and social flanks. For example, the lack of a regulatory plan in the Municipality of Heredia highlights the presence of interests between the groups and the consequent speculative dynamics of the big enterprises. Also, the construction of commercial and residential complexes put pressure on public services such as the supply of drinking water, wastewater management, and urban and industrial waste. On the other hand, they also cause pressure on adjacent services such as financial, health, and education, which encourages the development of new structures such as road networks for access and exit from the city. However, all this infrastructure could be located in areas of seismological risk, which depends not only on the presence of their geographical characteristics but also on the population density and quality of the constructions. Additionally, the loss of forested areas, the increase in carbon dioxide (CO2) in the air, and the presence of more heat in the atmosphere weaken the right to quality of urban life in the territory [3]. Along the same lines, the manifestations of climate variability are evident in water supply problems in the Heredia population. Since 2004 there have been problems with the supply of drinking water, which is scarce in the dry season [4]. Another contributing phenomenon is the increase in population in the Canton. According to the National Institute of Statistics and Censuses (INEC), Heredia Centro has a 100% urban population [5].

2. Material and methods

The realization of this research included the application of an interview to 17 students of the administration career and enrolled in the administration and environment-course. The questions were asked in a virtual class session. The students openly explained their experience in remote educational platforms, challenges, difficulties, learning, opinions on the perception of academic capacities and resources conditioned by virtuality. Parallel to this, in the virtual meetings of the teaching team, the methodological modification is elaborated. The national emergency conditions, the available resources, and the use of the personal budget were considered to carry out the inspection tours and data collection - which allowed meeting the demands of the social and institutional context of the moment. An interview was applied to the teaching staff involved in the project. Investigation reports were made, and the competent authorities promoted the taking of agreements; the above was to comply with scientific research advances. On the other hand, six work tours were carried out in the project's area of influence; for this, vehicles and walks were available at different times during the opening periods of the health restrictions due to Covid-19. In addition, information was scrutinized in national registries, databases, and institutional reports and then ordered information in a matrix form.

3. Results

Since the declaration of the national emergency due to the Covid-19 pandemic, academic activity is radically transformed. The methodological framework for teaching environmental management in the administration and environment-course changed. This generated four moments:

1. It was rethinking the methodological design of the project.
2. Availability of conditions for the adaptation of homes in virtual work centers.
3. Modification of obtaining bibliographic material is one of the primary pillars of teaching.
4. Accelerated adoption of virtual learning.

During these moments, there were barriers and a range of disadvantages that have shaped the dynamics of the project.
3.1. Rethinking the methodological design of the project

The methodological modification arises from analysing the current context and the institutional conditions in the pandemic season. All fieldwork that included the application of interviews and face-to-face surveys were limited to 2020. Under this condition, information collection is proposed through reports available in the different virtual sites, online bibliographic documentation, documentaries, interviews by mail. Electronic and phone calls. In addition, the professors participated in the training scheduled by the different institutional documentation centers during non-working hours, all to adopt more effective search skills in the scientific information databases. Also, the teachers went to the audiovisual material available on the YouTube application to quickly know and learn the use of digital tools such as Google forms and Google calendar. Together with the above, satellite imagery applications such as Copernicus Sentinel and Sentinel-2 NDVI Maps and geographic databases generated by national and international institutions were considered. These technological tools contributed to the process of updating the knowledge baggage, as well as the methodological process of the project.

3.2. Availability of conditions for the adaptation of homes in virtual work centers

In two months, the teachers' homes were adapted to meet the demand for remote training led by the institution. In this stage, five adjustments were presented for the optimal functioning of remote academic activity. The first adjustment that was made was the layout and conditioning of the physical spaces of the private residences. Among these are contracting Internet services, purchasing office equipment, and remodelling the physical space. It should be noted that the speed capacity conditions the offer of Internet connectivity in the country; this suggests that: the higher the speed, the higher the price. The same happens with mobile data; once these have been consumed, more must be purchased at higher prices. It should be noted that this price speculation occurred in office supplies and equipment such as desks, chairs, printers, computers, cell phones, tablets, microphones, and headphones. This situation resulted in teachers and their families adjusting their household budgets, this being the second modification they made. This need added concerns since the family budgets did not have enough provision to face the purchases and remodelling of the residences in remote classrooms. The third adjustment is coordination and communication with family members, as the rest of the family was expected to understand the new work routine at home. In some cases, this was complicated since the primary, secondary, and university education system was transferred to the bosom of families. Such a state put in evidence the pressure exerted on the spaces and equipment suitable for virtual academic activity. Usually, there is a person from the family receiving remote classes or demanding space to exercise telework. The fourth adjustment has to do with the balance between work time and time spent on personal activities. This represented an important challenge in the family organization since all the members understood and respected working hours. The teacher was used to enjoying his residence as a moment of rest and privacy, an aspect that breaks out with the pandemic.

3.3. Modification of methods for obtaining bibliographic material

At the beginning of the second semester, the interdisciplinary team met to define the lines of topics, and research instruments in which the students enrolled in the administration career would participate. The decision was made that the topics would be related to business management and that it would be part of the agenda in the study program. Adjustments were made in the content and research techniques. Seventy-seven students enrolled in the Administration and Environment course participates in this experience, and they are asked to organize themselves into subgroups to carry out the tasks. The students plan the formation of the groups and the internal organization. In this aspect, the teacher does not intervene since he seeks to stimulate the initiatives and organizational capacities of the student body. The work scheme granted by the teacher begins with the research work in companies located in the central canton of Heredia. The teaching team chooses companies. The companies were selected for: size, economic impact in the area of action, having legal status, belonging to the governmental structure, and having a database of environmental impact available to the public. With the pandemic, this methodology is conditioned, and the range of action of the study area is expanded since the students were in their places of origin. Therefore, the research and assignments were carried out in the Canton of Heredia and other country areas, such as the South Zone, North Zone, and Central Pacific. All of this is
for the students to remain in their residences and achieve the academic objectives contained in the learning proposal promoted by the project. In their role as the facilitator of the virtual educational process, the teachers provided training in Internet search tools to reinforce the capacity and speed of the educational work of the students. The support networks of the Institutional Documentation System of the National University (SIDUNA) were also monitored, as well as the databases that operate nationally and internationally. The contact lists of people in charge of the companies' environmental management areas were provided in this activity. They were supported with the preparation of the questionnaires, which were applied through the survey platforms and institutional email. So, to maintain the information order, the shared Drive between students and teachers was enabled. Students placed the documents, videos, surveys, maps, and applications necessary for the course. The information was arranged chronologically in the virtual spaces of the institutional platform and the Classroom. This form of work demanded more time and work from the teaching staff. Despite this, the teacher shared the educational material with peers and students, contributing to the exchange of information and databases.

3.4. Accelerated adoption of virtual learning and its impact on academic management

Facing the institutional instructions, the academics begin the process of remote classes, for which it makes available the institutional virtual classroom and a range of educational platforms. The faculty did not have, until that moment, vast experience in platforms such as Zoom, Teams, Meet, Screencastify, Classroom, YouTube channel, and applications for the production of educational videos. When the teacher is anchored to the institutional Web system named: "Self-learning space for the use of ICT as support for teaching" [6,7], with this, he tried to solve the demand for virtual educational tools. Each of these virtual teaching tools had to be learned self-taught or with the support of some colleagues who generally knew the tool. In those two months, the adjustment was made for the migration of the face-to-face activity to the remote one, the guidelines for the reformulation of the study programs, the elaboration of diagnoses for remote portability by the teaching and student staff, were coordinated feedback sessions with the participation of the team of researchers and the directors of the schools involved in the project. All these activities contributed to the virtual migration of the academic programs linked to the research project and amalgamated the pedagogical proposal linked to the remote educational activity. In April, the teaching support department began the virtual training sessions with the course entitled "management of online virtual tools," which made videos and training sessions available to the teacher to manage these tools. This was an important effort, as it facilitated the incorporation of new virtual teaching techniques into the academic curriculum. For example, the Center for Computer Management (CGI) of the institution, supported with the improvement of the institutional, educational platform, called "UNA Virtual Institutional Classroom" [7,8].

In another area, the interviewed students emphasize that remote presence has not been an impediment to carry out the professional training process. They report that they liked the remote system because it allows them to optimize the time resource and save on transportation, housing, and food expenses that face-to-face demands. They affirm that they increased academic productivity and that they were comfortable with this modality. Most of them did not present any limitation in terms of device arrangement or connectivity. All this favoured the excellent passing of the course.

4. Discussion

The sustainability of the teacher training process presents four challenges linked to the characteristics of each area of knowledge present in the research and teaching project. The first challenge was the unification of the diversity of concepts of each area of knowledge. The conceptual discussions laid the foundations for the construction of the theoretical framework. This effort stems from the work interaction of the project members; This gave added value to the applied methodology. In other words, the scientific discussions enriched the thinking and holistic character of the team and, with it, the contribution to the generation of scientific knowledge in all the disciplines represented. A second challenge was constructing the criteria for the generation of detailed cartography. The information generated was used in the classes and served as a source of future scientific publications. In this aspect, a mixture of research methods is defined that facilitated the study of the project area. Some
of these are Use of geographic information systems, photo portfolios since 1962, satellite images, tours of the area, and consultation of maps prepared in national institutions. All this information was ordered according to the logic carried out by the members of the project. Therefore, each contribution by the teacher was shared and incorporated into the database created and managed by the teachers who were members of the project. The custody of the databases was in charge of the teachers of the geography majors. Substantial support was the institutional capacity to cover the costs of the software licenses required by the teachers.

Under this panorama, integrating the teacher's different capacities and research abilities represented an exciting challenge. The scientific observation capacity of each teacher stimulated integrated analysis and produced a large amount of information. This set of scientific information became the methodological strength and analysis of the research. This encouraged coordination actions both in groups and subgroups without losing the integrated nature of the project. Learning became a constant challenge and exercise for teachers in pandemic conditions; transmitting knowledge through remote activity was a significant challenge.

5. Conclusions

Due to the Pandemic, the national emergency forced us to consider teaching and learning in the research and teaching project, which involves three schools: Geography, History, and Administration. These changes led to new techniques, methods, and implementation tools to carry out fieldwork. All of this prompted self-taught learning on the part of the teacher, who went from face-to-face teaching to remote virtuality quickly. This represented the development of the resilience capacity of academic staff. But also, he demanded extraordinary working hours, which the teacher assumed without any financial compensation. That extra work time was invested in self-training, assistance to Webinars for the mastery of a technological tool to contribute to the management of the virtual classroom, such as creating educational videos. The university authorities promoted the development of new learning technologies. The pedagogical discussions were the foundations of the methodological proposal in the teaching of environmental management—this proposal adhered to culture and technological capacity.

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