

Promoting teacher competencies towards sustainability conducted through STEAM interventions in IndagaSTEAM Escuela Project

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TOPIC 1 or 2, Proposal for Paper presentation

1. School Culture supporting STEM Education

Education improves constantly, so lifelong learning and continuing education/professional development are a way of being updated on almost every innovative knowledge approach and learning strategy. STEM education contributes to scaffold a holistic educational framework curriculum. In this line, to establish School Culture supporting STEM education is relevant to foster an education reform at all levels.

Place-based learning STEM approach in real-life contexts provides school subjects meaningful elements either for teachers/professors or students. Furthermore, when implementing constructivist teaching-learning approach, problem-based learning, and connections with real world items in the classroom, STEM approach is very efficient, specially using inquiry-based strategies. However, STEM Education goal refers to a holistic integration of STEM areas across the curriculum, although it seems to lack specific scientific literature related to how STEM acronym (and disciplines) should be implemented, because the whole is greater than the sum of its parts (Aguilera et al., 2021).

2. What is IndagaSTEAM Escuela Project

Professional development programmes can simultaneously explore mechanisms for integration across STEM and non-STEM disciplines, and help existing teachers develop a deeper understanding of the subjects they teach. (Margot & Kettler, 2019). They involve a shift from the teacher's role as a transmitter of knowledge to a facilitator of knowledge, helping students to identify and use relevant sources to solve real-world problems. Sustained professional development programmes could have a positive impact on teacher teaching and student achievement. These programmes may also use a mentor or peer coach, allowing teachers to apply their learning in the classroom with the support of a peer coach. (Cotabish et al, 2013).

IndagaSTEAM Escuela Project is an experience to promote transfer of learning for students during their teacher training at schools -for compulsory education- to develop students' key competencies, conducted through cooperation between schools and universities by mentoring interventions (Lupión-Cobos et al., 2021).

Moreover, the following points are taken into account when designing the project programme: a) Teacher/Student centered approach, b) A curricula reform, new organizational system and new teaching materials, c) HE & School projects implementing inquiry-based learning and place-based learning (Morrell et al., 2020; Author, 2021), d) Teaching and activities selection and design for Professionals and Students, and e) Activity impact evaluation to aim the goal. In particular, several didactic aspects of the training process were addressed:

- Teaching as examining one's own practice in the classroom/reflecting as a professional: Teachers as managers of change and transformation in schools.
- The systemic nature associated with the change that it implies as an innovation in teaching practice requires consideration of different influencing elements (curriculum, school organisation, professional development or teaching materials, among others).
- School projects, using inquiry and contextualising strategies, have been identified as helpful training scenarios for applying STEM education objectives (Morrell et al., 2020; Author, 2021), which clarifies educational purposes and guidelines for its treatment.
- Activities to be used and how they fit in. The teaching skills to select and design them allow to formulate coherent and solid proposals with the intention of the proposed model. Its identification and design thus becomes a training objective that also articulates an expectation of professional practice.
- Systematically evaluate the impact of actions (interventions) and provide evidence/research evidence to guide improvement.

The program professional development of participants (teachers) is mainly focused on empowering and motivating learners to become active sustainability citizens, fostering critical thinking, and participating in shaping a sustainable future (Leal Filho et al., 2019). Thus, the project articulates teacher sustainability competences (Rieckmann, 2019). This proposal describes teacher sustainability competences through a project design and its implementation to establish relations between them: a) PBL STEAM “How can I improve my environment” (Topic 2 “material”) and b) sustainability competences by the teacher (Topic 1 “personal”).

3. PBL STEAM “How can I improve my environment” for teaching competences associated to Agenda 2030

The school project was designed and implemented in primary schools (6-12 years old children) by primary school teachers during 2020-2021; 2021-2022 course. It was developed in 6 weeks (from 2nd half of April to May), divided in three phases (1 = Initial, 2 = Development y 3 = Final) which includes 7 work sessions with activities for students who were working in a Class Group (CG) and in Small Groups (SG)).

In phase 2, the teacher helps pupils to develop their understanding of the world as an interconnected whole, to look for connections in the social and natural environment, and to consider the consequences of their actions, by visiting a natural environment located close to the school. Its design is planned as a work project tackled from a transdisciplinary approach, with STEAM areas being its backbone.

At every session, collecting data tools are used to evaluate results (which are likely to be used either for students or the project).

Initial phase starts with a CG kickoff workshop introducing the topic environmental awareness & sensibilization and reflect about 2030 Agenda for Sustainable Development Goals (SDGs), enabling students to focus the problem to be addressed (environmental pollution), using thinking techniques (Word-Idea-Phrase). Activities design and implementation allow teachers to initiate a wide range of competencies related to sustainability at each phase of the project, which are categorized according to Rieckmann’s description (2019) (Figure 1).

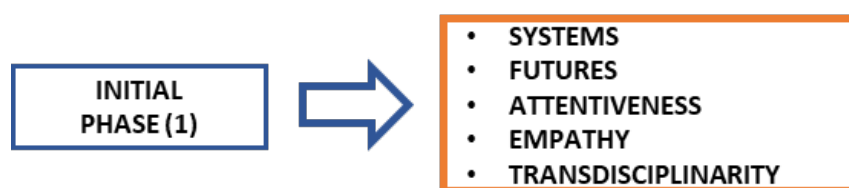


Figure 1. Sustainability competences for teachers expressed in phase 1 of the project

Phase 2 & 3, foster the sense of understanding our interconnected world (with teacher support), searching links among social and natural areas, bearing in mind how the consequences of one action's would affect the environment. Furthermore, a nearby natural site is chosen for a scholar visit which needs a former inquiry. Students (CG) search for information and draft an "Environmental Eco-audit" which allows them to know and contrast "in situ" the environmental location and its characteristics. Moreover, students are asked to explore future alternatives and use them to deliberate about how they might change their behaviors to support sustainable development, driving their work to elaborate an "Eco-Tourist Guide", to design "Informative-persuasive signage to promote good habits", and a proposal at the school for "Creation of vertical gardens with native aromatic plants". In addition, critical thinking related to non-sustainability actions are launch by the teacher fostering sustainable awareness and the need of a societal change, from a receptive and inclusive perspective, reinforcing their sustainable believes and values. In Phase 3, SG presents their Final work to CG, by oral presentations using murals, posters and/or digital resources.

The whole project implements transdisciplinary lines, especially using STEAM as main axis, fostering creativity and proactive decision making, so as strength students to critically evaluate the reliability of environmental management models, accepting responsibility for their work acting prudently and timely.

Sustainable competences for teachers described by Rieckmann (2019) are always bearded in mind (Figure 2).

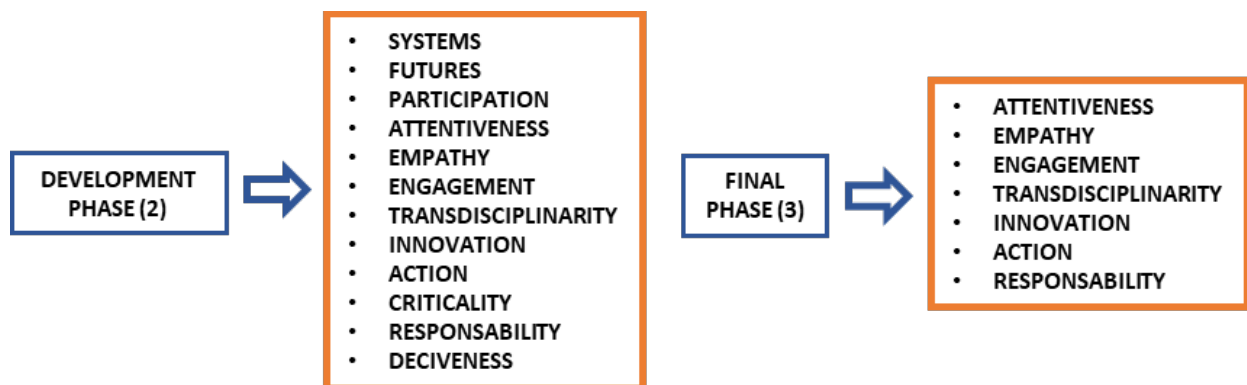


Figure 2. Sustainability competences for teachers expressed in phases 2 &3 of the project.

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