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Acquisition of Competences for Sustainable Development through Visual Thinking. A Study in Rural Schools in Mixco, Guatemala

Silvia Carrascal ^{1,*}, Montserrat Magro ¹, Juana María Anguita ² and María Espada ³

¹ Faculty of Education and Health, Camilo José Cela University, Castillo de Alarcón 49, 28692 Villanueva de la Cañada, Madrid, Spain; montserrat.magro@alumno.ucjc.edu

² Faculty of Communication Sciences, Rey Juan Carlos University, Camino del Molino S/N, 28943 Fuenlabrada, Madrid, Spain; juana.anguita@urjc.es

³ Faculty of Physical Activity and Sport, Polytechnic University, Martín Fierro 7, 28040 Madrid, Spain; maria.espada@upm.es

* Correspondence: scarrascal@ucjc.edu; Tel.: +34-610788190

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Abstract: The acquisition of competences for sustainable development can be promoted in educational contexts through Visual Thinking. This study is based on the implementation of the Visual Arts in Education (VA.E) project and the development of a programme of socialization and training for teachers of schools in area 6 of the city of Mixco in Guatemala. The participant observation and research action are the core methodological tools to study four key competences, namely critical analysis, systemic analysis, collaborative work or work through projects, and commitment to society. The results were obtained from the analysis of the competences and capacities acquired during the training process, in which students and teachers participated and expressed through observable learning conducts or achievements. The proposal aims to contribute to the study of the impact of Visual Thinking as a tool for teaching-learning of students in rural schools, and of teaching practices based on the acquisition of competences for sustainable development that can be assumed by teachers in all educational levels and contexts.

Keywords: education; competences; Visual Thinking; sustainable development

1. Introduction

Present-day society has a global and plural profile due to the fact that we are undergoing constant change, both social and human. This change is closely related to current economic, migration, and cultural exchange transformations. Education appears as a key tool for social cohesion, apart from being the fundamental axis of knowledge and competence acquisition able to generate a sustainable society. Because of this, it is necessary to study and analyze the results provided in the UNESCO's report on Education for All 2000–2015 in order to plan for flexible education that can meet the needs of social, cultural, and educational diversity at an international level. The education of citizens to enable them to acquire a positive view concerning diversity and global society requires worldwide planning of new educational policies, both through dialogue and cultural exchanges, and in support of human rights, human dignity, and social inclusion [1,2].

The UNESCO Incheon Declaration and Framework for Action for the implementation of Sustainable Development Goal 4 highlights that people's educational process is lifelong and that it is geared at giving them the capacity to think and feel. Likewise, it upholds that all agents in a city contribute to education and culture, and thus favour human development [3–5].

Murga states that in order to face this challenge, it is essential to provide training based on the acquisition of the competences and skills that will permit building societies capable of developing in a sustainable manner, focusing on the key competences proposed by UNESCO: critical analysis, systemic reflection, collaborative work or work through projects, and commitment to society [6].

Said competences are complex and require diversified educational strategies and transversal training processes. For this reason, it is important that all teachers at all educational levels actively include in their teaching practices the principles and values of sustainable development [4].

The Global Action Programme on Education for Sustainable Development (GAP) approved in 2014 by UNESCO's General Conference has two major objectives, which are included in the two global agendas following 2015:

- i. To reorient education and learning so that everyone has the possibility of acquiring knowledge, competences, values, and attitudes needed to contribute to sustainable development (United Nations).
- ii. To reinforce the role of education in all action plans, programmes, and activities to promote sustainable development [7].

This road map includes five other priority lines of action, of which two can be significantly addressed in the field of education: (a) to integrate the principles and values of sustainability in the contexts of education and training, with a focus on the processes of curricular sustainability, and (b) to reinforce the capacities of teachers and educators to enable them to exercise their professional practice effectively in the framework of Education for Sustainable Development (ESD).

In this sense, Murga states that in addition to managing these educational contexts with sustainability criteria, new contents have to be included in the learning process, integrating into the training programmes the most urgent social and environmental problems, namely climate change, biodiversity, handling risks of catastrophes, and sustainable production and consumption [6].

The objective is that students acquire, at all ages, the fundamental competences of critical analysis, systemic reflection, collaborative decision-making, and a sense of responsibility in respect to present and future generations [7].

In addition to historical and social aspects, education also intervenes in the culture of all societies or groups. As a result, society needs active educational policies that favour the development of learning through intercultural and transversal education, planning programmes that respond to this diversity of cultures around a central axis that is common to all of them, such as sustainable development. In this context, reality represented by images can favour cognitive development and learning by means of visual literacy, something that is universal and is within everyone's reach, since it does not require many resources [1,8].

By means of images we can reach different areas, societies, cultures, peoples, and beliefs. As part of their educational tasks, schools teach children traditional linguistic content, which in turn widens the gap separating them from more innovative contemporary methodologies. These methodologies propose a higher level of critical abilities on the part of students, aimed at developing operational skills and competences as part of the decision regarding what to teach [9].

The objective of these modern practices is to achieve the emotional and sentimental development of each individual as part of a "know how" and "know how to be", in line with the demands of the new knowledge and information society. Hence, we consider that visual literacy contents are essential in schools, with the aim of demonstrating the importance of this method and its repercussion on meaningful learning.

In this sense, teacher training is also very important for the development of educational competences suitable for the reality of an information society. Likewise, the development of a disruptive teaching methodology and an open and critical attitude in respect to current society will foment a reflexive process and an analytical vision amongst students [1].

Both the definition of competences in line with sustainability and the set of knowledge, abilities, skills, and aptitudes that enable solving sustainability problems or demands have been studied by

different authors in recent years [5,10,11]. On the basis of the revision carried by Lambrechts and Van Petegem and Wiek et al., it was initially determined that sustainable entrepreneurs required 5 key competences to deal with the challenges faced by society in respect to sustainability [12]. In a subsequent study of the sets of competences proposed by different authors, Ploum redefined the list of the 6 competences that teachers should have in order to address with determination the challenges of an information society and sustainable development:

1. Systematic thinking competence: capacity to know and understand relations, complex systems in their different domains, and sectors.
2. Understand diversity and interdisciplinary competence: capacity to structure relations and the ability to identify a problem and its legitimacy in different points of view in connection with decision-making.
3. Prospective thinking competence: capacity to analyze, assess, and visualize images of the future, as well as consequences
4. Normative competence: capacity to understand norms and values, according to which we carry out actions, and for negotiation in areas of conflict of interests, amongst others
5. Interpersonal competence: the ability to motivate, design, and facilitate situations and participative collaboration studies, together with the concepts of leadership, strengths, weaknesses, successes, and failures.
6. Strategic management competence: capacity to design collective projects, implement interventions and strategies for sustainable development, and the ability to become actively engaged in, and assume responsibility for, decision-making [5,10,11].

This model of competences enables consideration of sustainability as an opportunity to resolve problems through the construction of appropriate solutions, in which creativity and innovation bring added value to the process.

Likewise, the contributions made by Lambrechts and Van Petegem coincide with the previous model. They maintain that sustainability research and problem-solving competences must be integrated so that key competences can converge to obtain global results [12].

On the other hand, and in connection with this study's methodology, we consider that it is relevant that teachers, in addition to the having these general competences, should also be able to deal with planning and carrying out educational proposals, hence requiring a series of competences much more connected with practical applications. In this sense, Murga highlights four competences that teachers must have to face the challenges of an information society:

1. Knowledge of the subject matter and of current culture: cultural competence.
2. Pedagogical competence or teaching skills that enhance the effectiveness of the teaching-learning process.
3. Instrumental skills and knowledge of new technological, audio-visual, and language advances.
4. Personal characteristics, such as maturity, security, self-esteem and emotional balance, empathy, imagination, etc. [6].

On the basis of the foregoing, and in order to put our research into context, in the following sections we will deal with education through new teaching models that allow students to acquire social skills, and the processes of Visual Thinking or the use of images in meaningful learning.

2. Education and Dialogue: Key Elements for the Evolution and Development of New Learning Styles in Order to Promote the Acquisition of Competences and Social Skills

In the international sphere, education has had to adapt to growing diversity. The new multicultural and multiracial society includes citizens from different countries with a plural profile related to their culture, religion, and place of origin, and with a personal identity related to their customs, habits, and beliefs. In consequence, education has to be provided from a perspective of dialogue [13].

This dialogue stems from the coexistence of people and exchanges between them, and must be flexible, open, reciprocal, and critical; any actions contrary to citizens' fundamental rights must not be accepted. Intercultural dialogue is both a need and an emergency, but given its plurality, it requires that society be prepared for that purpose. Therefore, an education that is based on respect and tolerance for diversity will promote coexistence and dialogue and will always reject any kind of conflict and violence [4,14].

Children need cognitive skills that are both social and emotional in order to acquire a global vision of the world and be successful in society. It has been proven that social skills, as well as cognitive and emotional ones, influence people's educational and professional success. It has also been proven that persistence, sociability, and self-esteem have an impact on many social achievement metrics, including health and well-being improvements, as highlighted in the OECD 2015 report [2,8].

As stated by Sáez *"la educación es el mejor medio que tiene la persona para su formación y desarrollo"* (education is the best means a person has for their training and development), and it is one of the instruments that helps one acknowledge the value of cultural diversity, overcome racism and xenophobia, and promotes communication and acquisition of intercultural competence and social skills [8] (p. 844). According to this statement, education has to be dealt with, on one hand, by teachers from a transformative perspective and with a global and innovative approach to develop good teaching practices, and on the other, by different relevant institutions capable of developing responsible educational policies.

This approach coincides with Rieckmann's, who states that the fundamental social transformations required to achieve sustainable development should entail a change of perspective in Higher Education. Likewise, the role of universities and teacher-training centres is essential in providing teachers with the necessary tools they will use in the exercise of their functions to develop key competences for sustainability [11].

In this sense, Ploum et al. emphasize the importance of enhancing individual competences for sustainable development. Mulder, in turn, defines them as the capacity and ability oriented towards personal development in order to achieve specific goals [10,15].

The importance of individual competences in sustainable development lies in the consolidation of agents of change, which strengthen sustainability as a factor of success in their surroundings and in society. Thus, Ploum et al. conclude that the most valuable individual competence that should be reinforced amongst sustainable entrepreneurs is the capacity for action, which implies knowledge and perception of the problems and commitment, motivation, and impulse to resolve them, as well as the capacity to visualize future alternatives to transform the world and real, active participation in specific sustainable actions [10].

As mentioned, individual competence is correlated to the key competences identified in the different studies. These competences are systematic, anticipatory, and critical thinking skills; the capacity to handle complexity; interdisciplinary work, literacy, and abilities for sustainability; the organization and interpretation of data, as well as cooperation for participation and empathy. In consequence, they are considered to be important objectives in educational processes and contexts; hence, the importance of consolidating individual competences. Once the personal dimension of competences is sufficiently consolidated, other competences are interiorized and develop positively [6,11].

A quality education, together with the development of new teaching and learning styles, is the essential vehicle to prepare and introduce the values of dialogue in our society. In this sense, since its creation, and more specifically in the last two decades with the development of its Education for All 2000–2015 strategic plan, UNESCO has provided an answer to the objectives laid down in the Dakar World Education Forum held in 2000 [2,13,16,17].

In addition to considering the Dakar goals concerning literacy and human rights, UNESCO promotes giving very special attention to diversity, both by the media and by education. These two concepts of education and dialogue cannot be separated and should take part in a general process for the enrichment of humanity based on the acquisition of competences and social skills [2,18].

At the present time, education, apart from contributing to the training and acquisition of competences and to the specialization of students, takes on a relevant role in society with the challenge of training citizens to transform the world. UNESCO, in the “17 goals to transform our world” of the 2030 Agenda for Sustainable Development, states that the achievement of a quality education is the key element to improve people’s lives and achieve sustainable development [19].

So far, there have been important advances related to access to education for all at different levels. Because of this, and in order to actively contribute to this strategy, education should guarantee that students acquire all the necessary theoretical and practical knowledge with the aim of boosting sustainable development [20]. Among other things, it has to promote sustainable life styles, human rights, gender equality, the culture of peace and non-violence, world citizenship, and the value of cultural diversity, as well as the contribution of education to development [3,21].

In this sense, the analysis carried out by Jickling and Wals in connection with the policies that have promoted a change in education in order to enhance sustainability detects anomalies in the purpose and the nature of environmental education, such as globalizing trends focused on vague and problematic concepts. This is why these concepts must be interiorized by educators dealing with the environment, sustainable development, and ecology [22].

Thus, the international debate amongst experts in the matter reveals the need to reconsider implementation of sustainable development policies as a discussion of world values, perspectives, and ideologies, instead of establishing other standards, reference criteria, or control mechanisms for progress.

In order to actively contribute to this strategy, we believe that education must reinforce the theoretical and practical knowledge required to promote sustainable development, contributing to the critical reflection on individual and collective decisions and responsible behaviour from a perspective geared at the future of the planet [6,11,22].

UNESCO recently published a document entitled *Global Citizenship Education. Preparing Learners for the Challenges of the Twenty-First Century*, where global citizenship education (henceforth GCE) is advocated as a paradigm that can develop attitudes, knowledge, values, and social skills necessary for students to generate an environment that is socially responsible, fair, inclusive, and sustainable [23].

In this sense, the importance of GCE is based on the acknowledgement of the value that education has in order to understand and pursue global issues that affect the whole world in its social, political, cultural, economic, and environmental spheres [10].

If social skills are developed in early years, they will lay the foundations for future potential developments. Therefore, we can assert that skills are built upon previously developed skills [16,17].

In this regard, investment in education and skills is one of the key policies in order to address many of the current social and economic challenges, and to train future citizens to be committed to the global society [6].

Thus, different governmental bodies, such as the European Parliament and the Council, promote the need to educate on the basis of competences to achieve lifelong learning as an essential European measure in the face of globalization and social changes. The European Reference Framework of Key Competences for Lifelong Learning defined the competences each European citizen needs for personal fulfilment and development, employment, social inclusion, and active citizenship [24,25].

Along this line, Tilbury points out that the United Nations launched a Global Action Plan in Education for Sustainable Development (ESD), recognizing the power of education to transform our thinking as well as our actions, and that UNESCO established a global platform that will bring together implementation partners from across all sectors and from around the world to work towards two key objectives:

- Embedding education into plans and efforts to address sustainable development;
- Embedding sustainable development into institutional educational priorities, curricula, and pedagogy [7].

On the other hand, Wals points out that the goal of Education for Sustainable Development is to educate and train students for sustainable decision-making in the future through social learning, a special form of transformative learning [26].

Nonetheless, in order to achieve these objectives, the work of institutions and the ESD skills of teachers are essential. Many schools are still struggling to advance from a stage of experimenting with and assimilating ESD, to ESD on a project basis (also referred to as a bolt-on approach), and finally to a more structural and strategic incorporation of ESD into the school's mission (built-in approach) [27].

Along this line, an exploratory interview study at three pioneering schools in Germany that have started to establish sustainability reporting mechanisms highlights, as its main conclusions, the potential of sustainability reporting at schools to contribute to an increase in student participation in sustainability-related activities at school, create accountability concerning the school's efforts, help structure existing sustainability projects, and demonstrate new possible courses of action [28].

In respect to teacher skills, recent research carried out in Namibia concludes that professors described ESD mainly in terms of creating environmental awareness to ensure the sustainable use of natural resources, and all teachers acknowledged the integration of ESD into their subjects and school curriculum to respond to the challenges of sustainability in order to improve the quality of the environment [3].

3. Visual Thinking as a Tool for the Acquisition of Competences and the Development of Capacities and Attitudes in Educational Contexts

Visual Thinking comprises all those actions that entail a visual perception. With the passage of time, new developments and new forms of expression have been introduced in this area. Visualization of images, and thus of art, plays a fundamental role in human culture by fostering an understanding of a variety of conditions of existence. In this sense, works of art, photography, and any graphic representation make it possible to represent in different ways the socio-cultural, political, and economic context of a community, amongst others. The art is, thus, the door to imagination and the vehicle to examine the current world from other critical perspectives, contributing to the development in individuals of a responsible sense of action. Hence, Visual Thinking becomes a strategic field that enables one to verify that perception is not only the recipient of information, but that it also includes and strengthens cognitive functions. In other words, it implies the integration of all the senses, with thinking being construed as the greatest mode of perception, something that has a direct impact on the acquisition of competences and the development of skills in Education [29].

The studies carried out by Arnheim, author of the concept of Visual Thinking, emerged from the analysis of visual perception as a cognitive activity. He declared that perceiving and thinking are acts that are intrinsically interwoven. For him, it is impossible to think without recurring to perceived images. This allowed him to state that given the existence of different types of thinking, Visual Thinking was a form of human knowledge. For Arnheim, this type of process entails thinking conceived on the basis of learning about the world and about what is a human element, thus establishing a commitment with what one sees.

The development of learning is mainly mediated by the senses, which permit receiving and expressing information (once it has been codified by the physiological mechanisms of the central nervous system by means of neurological processes). This way, the sensorial organs process two types of learning: visual, kinaesthetic, and auditive. According to some authors, in 40% of persons visual learning predominates as the primary style of learning, whereas in 30% auditive learning predominates, and in the other 30% it is kinaesthetic learning that predominates. Hence, the percentage of priority in the reception of external stimuli that generate learning is distributed as follows: taste 1%; touch 1.5%; smell 3.5%; hearing 11%; and sight 83%. Another study carried out by Pérez, Soto, and Rojo demonstrated that persons, irrespective of their gender, had more cognitive reactions through visual stimuli than through sound or tactile stimuli [30].

Along this same line of research Razumiejczyk, Macbeth, and Leibovich demonstrated with an experimental quantitative study that linguistic-visual stimuli have better results over operational memory than acoustic stimuli or those resources that are traditionally used in training or teaching processes [31].

This learning process is considered a tool incorporated in individuals in a natural manner, enabling them to rapidly group a set of techniques in visualizing ideas. In consequence, we can state that Visual Thinking necessarily implies the involvement of the subject or subjects who contemplate or create, and who make sense out of, or give meaning to, an image.

Likewise, it is also considered that in these types of thought processes, abstract and emotional thinking can be joined, given that what is visual will always be synonymous to feelings and emotions, which arise from personal and universal constructs of individuals. Consequently, for them the essence of Visual Thinking is not exclusive of observation and image analysis—the real key of Visual Thinking is in the production of thinking about connecting or making images.

It has been established that problem solving is one of the most effective forms of enhancing meaningful learning. In this sense, Visual Thinking contributes to improvement through the different alternatives for problem solving, and in the composition and decomposition of sketches, enabling the constant assessment of the phases of the project that is underway, but above all in the awareness of something for the group or the individual creating the image [14].

Sibbet, a humanist academic whose studies have focused on the techniques of Visual Thinking, emphasizes that it not only consists of techniques, but that it is also a vehicle for strengthening the leadership, commitment, and participation of persons. Techniques are a fundamental part of images and words in the creation of visions and strategies with visual techniques [14].

The essence of Visual Thinking lies in the improvement of systems or ideas. This tool is closely related to innovation processes, contributing to the development of critical thinking and creativity [32]. Visual methodologies, methods, and techniques were classified based on the existence of four visual functions:

- Cognitive visualization: includes mental models, paradigms, frameworks of reference, and visions, amongst others.
- Visualization of data: this refers to the organization of data, financial matrices, and simulation of models, amongst others.
- Graphic design: this refers to architectural designs, websites, and applications, amongst others.
- Visual facilitation: some examples are Graphic Recording and Strategic Vision.

Mixing two or more visual functions results in transversal activities or methodologies, such as Design Thinking (which stems from mixing cognitive visualization and graphic design), which contributes to the innovation and background of the strategic and planning phases.

Moreover, Roam establishes four steps for processing Visual Thinking: *To look*, by which we obtain, collect, and select visual information; *to see*, by which we identify what is pertinent and interesting in grouping information; *to imagine*, which consists of the interpretation and manipulation of the elements to construct new guidelines; and lastly, *to show*, in other words, obtaining a new guideline and sharing it with experts or other persons, contributing to feedback [29].

On the other hand, environmental education has become a fundamental educational aspect for shaping an ethical awareness amongst the new generations due to its potential for the development of critical and constructive elements. This also requires teaching instruments and operations that are suitable for the contexts, differentiated according to their mediums and modalities, focusing on learning and suited to the different scenarios in which it occurs. Hence, the selection of the resources and methodologies for this type of education must correspond to the ones that generate the most and the best learning experiences, in which the students demonstrate through attitudes and skills the changes of conducts and actions that enable long term solutions for such a major problem as the present [17,33].

The apparent advantages of implementing Visual Thinking as an element of visualization and information, which entails manipulating and connecting ideas by means of drawings with the objective of better understanding the former, and of using Visual Arts in the classroom, present an opportunity to conceive a world based on the creation and production of the meaning of said world and of the different forms of signifying its real and ideal state, its social and natural elements, and its evident and metaphorical aspects; of signifying denunciation, indignation, and sublimation of what is tragic, dramatic, or puts us at risk. Thus, the need and the importance of education in visual arts is that it offers the opportunity to produce new visions, interpretations, and narratives [33,34].

The abundance of opportunities to work with and develop Visual Arts and Visual Thinking in the classroom enhances education for the development of competences related to a vision of environmental sustainability. Education geared toward the development of these sustainable competences must contribute to the progressive transformation of the guidelines to manage natural resources and social equity. Education for sustainable development has enabled better organization in order to detect priorities and to elaborate comprehensive projects in view of future self-management, in addition to providing greater access to knowledge and building of the footsteps to achieve sustainable development [34,35].

Parres and Flores have demonstrated that educational experiences mediated by resources based on artistic-visual resources include greater learning motivation [36]. In other words, said experiences enable academic self-regulation that goes beyond simple interpretations, enhancing subjectivity regarding a specific phenomenon or topic. Aichi-Nagoya's statement in favour of the foregoing upholds that sustainability implies strengthening critical thinking in individuals as a nodal element to understand abstract problems, and above all for the construction and consolidation of educators and students committed to work geared at fostering the achievement of sustainable results [37]. Moreover, critical thinking, such as Visual Arts and Visual Thinking, contributes to the analytic resolution of problems, decision making, and development of creativity and collaborative work, amongst other results. According to this premise, individuals are the central axis of sustainable development and education is the link to improve the reality of the different educational contexts [19,38,39].

On this basis, several educational and community initiatives have turned to engaging imagination in order to foment awareness of the world in which we live through multiple lenses and more structured thinking. This is the case in different countries of Latin America, where teacher training curricular lines have been fomented for the creation and implementation of teaching resources based on artistic representations that enable stimulating student comprehension and visual perception [1,36].

In this context, mention should be made of the community projects *Who's the Landlord* and *Memory-in-Progress: A Mother Daughter Project*, which have developed a struggle to represent the community's problems (stereotypes, segregation, and racism, amongst others), and at the same time as an attempt to maintain their vitality and their cultures. In addition to the implication of all members of the community in the projects, we must bear in mind that visual elements were an inherent component of these artistic productions [34].

In consequence, it is imperative to give students the opportunity to explore the different forms in which they can express their own ideas and have these circulate. For this purpose, artistic productions are an important vehicle for the formation and presentation of ideas generated through events and situations that emerge in different educational settings. In this sense, we can state that in general, the foregoing represents an innovative model for educational communities to create specific proposals and alternative solutions that contribute to the democracy of education in a critical and sustainable manner [38].

Visual Arts in Education (VA.E): A Project of Visual Literacy through Contemporary Graphic Images—Study of the Development and Implementation in Rural Schools in the City of Mixco in Guatemala

Visual Arts in Education (hereafter referred to as VA.E) is a research and participative action project with the main objective of influencing the teaching and learning process through an innovative

methodology based on visual literacy and Visual Thinking using contemporary graphic images of the impact caused by mankind on the environment.

The project aims to develop analytical, critical, and creative thinking at the different educational levels and contexts, based on an integrated and global perspective of knowledge and understanding of the surroundings, as well as the relationship of this matter with globalization and interculturalism.

The team participating in the work focused its research on the use and implementation, in different schools at an international level, of the E.CO Kit, a teaching kit regarding human influence on the environment, created by the General Deputy Directorate for Art Promotion of the Spanish Ministry of Education, Culture, and Sports. This teaching material is designed as a visual literacy proposal for children between the ages of 4 and 11. Its main objective is to foment amongst the children a process of reflection, analysis, and discovery with images, by means of games, comprehension, assessment, and apprehension of the visual arts. In this way, and under a critical, holistic, constructivist, and collaborative perspective, the students become the main actors of the process of creation of their own visual code and learning in the classroom.

The specific objectives were designed based on the didactic use of images and Visual Thinking for the development and motivation of creativity and learning, which has enabled analysis, in turn, of its contribution to the cognitive development, skills, and abilities of participants, assessing the importance of images in the achievement of key objectives of learning at different educational levels.

In the case of the rural schools of the city of Mixco in Guatemala, the VA.E team developed a parallel study of the general objectives of the E.CO Kit in order to implement its use through participative observation, and evaluate its didactic content with teachers in order to contribute to the results of the study's main objective: teaching and learning through contemporary graphic images based on globalization and interdisciplinarity as a tool to foment analytical, critical, and creative thinking of students of different levels in rural schools.

A collaboration agreement was reached on the basis of this premise between the VA.E project team and the Secretariat for Social Work (SOSEA by its acronym in Spanish) in the field of education and in the framework of the project of support to the work of teachers of the city's public schools, the main objective of which is to improve the quality of education through innovative programmes that benefit students.

The different agents involved in the development of local educational policies participated in the first phase of implementation and study of the VA.E project in area 6 of the city of Mixco in Guatemala, which facilitated contextualizing the project and favoured that its results have a greater impact on redesigning teaching practices.

Mixco is located in the western part of the capital city of Guatemala and has a total area of 132 km². It is considered a benchmark city by the people of Guatemala. It has more than 100,000 inhabitants, of which 35% are children, with 172 public schools containing about 54,000 students and 1859 teachers.

Contextualization of VA.E as a model of education for the acquisition of sustainability competences in the city of Mixco stems from the importance given to learning with images in the Cuban programme called "*Yo, si puedo*" ("*I can*") of the National Literacy Committee (CONALFA by its acronym in Spanish), geared at teaching literacy in 3 months to illiterate adolescents between the ages of 16 and 18, applied in Catholic churches and with indigenous communities, which has facilitated the involvement of public and private bodies in the implementation of the project, in addition to the issues of security, health, and education [40].

The schools of area 6, Muchachas Guías de Noruega, Yumar, Escuela Oficial de párvulos No. 41 and Escuela El Naranjito, together with their teachers, coordinated by the Departmental Education Directorate of Western Guatemala (Dirección Departamental de Educación de Guatemala Occidente) and the VA.E team, participated in the study and implementation of the VA.E project, which involved 12 teachers and 1432 student beneficiaries. In this case, the impact of the use of the E.CO Kit in the development of cognitive and creative capacities for critical and rational thinking was analyzed and assessed, in addition to its contribution to the development of intercultural education through the

images selected and worked with. The teachers (7 from Escuela Muchachas Guías de Noruega, 1 from Escuela Infantil n° 41, 3 from El Naranjito, and 1 from Escuela Yumar) participated in the coordination and implementation of the project, and in the analysis of the pedagogical value of the E.CO Kit, a key aspect for its use in favour of education for sustainability and acquisition of key competences.

4. Materials and Methods

The purpose of the research was to know the effects of visual literacy and visual thinking in the acquisition of competences for sustainability acquired by students with the teaching E.CO Kit, and to observe the possible inter-individual differences in this relationship. The general research hypothesis was the following: use of the Visual Thinking technique through graphic-visual resources and contents of the E.CO Kit has an influence on the acquisition of competences for the sustainability of students and professors of rural schools of the city of Mixco in Guatemala.

Promoting the non-conformist attitude of teachers and students regarding the state of the social and natural surroundings, and having identified the problem, different actions favoring social transformation and change were considered Figure 1.



Figure 1. Primary school students (class of 8–9-year-olds) of Escuela Yumar, working with the resources of the E.CO Kit.

In this study, the potential of action research of having an impact on teachers' professional development and contributing to the creation of knowledge was the main reason for selecting the action research method, specifically Kemmis and McTaggart's model (1988), the essence of which is based on Dewey's principles, which stress the importance of action learning, and Lewin's, who combines experimental research methods with the objectives of social change and improvement. With these main elements, the methodology is applied in the field of education as one that enables improving and transforming teaching through observation and reflexive analysis [18,41].

One of this methodology's most important conditions is the application of cyclical and emergent processes that can be executed in parallel or as a continuum [42]. Hence, on the basis of the planning and the activities proposed in the E.CO KIT and with the analysis and assessment of the effect of the plan of action adapted to the social context in which it is implemented and a methodology of universal learning, in this research project visual thinking makes it possible to obtain significant recordable results from observation in the classroom.

The methodology was applied from an action-research perspective, by means of participant observation, which fomented the participative character of the study, and its contribution to social knowledge and democratic values. These values promote our coexistence in society and are characteristics and qualities that are reflected in the materials, games, and tasks contained in the E.CO teaching Kit, using contemporary graphic images as the means for visual literacy and the acquisition of democratic competences and values. Pluralism, dialogue, tolerance, equality, liberty, and respect are some of the values that can be worked on with this instrument.

The agents involved in the process and in the context of the study, that is the teachers, public, and private entities and the research team, established relationships with the students and participated directly [28]. In turn, participative research was construed as a methodology that is directly related to the main objective of the VA.E project, in which all agents involved participate actively, becoming the main characters of the process of knowledge building and intervention in the surroundings and in reality.

In consequence, on the basis of the study's design, the action research methodology was conceived as the foundation for the professional development of teachers and agents of the public entities implicated, facilitating, in view of the results obtained, the improvement of their skills and competences for their teaching work and through a dialogue between the theory proposed by the United Nations and international policies regarding sustainability and practices, adapting them to the needs of schools and students [18].

To respond to this first general hypothesis, and on the basis of implementation of the E.CO Kit as pedagogical material for students 4 to 11 years of age, the following hypothesis was formulated:

- The didactic E.CO Kit is an effective teaching-learning instrument to improve visual literacy and the acquisition of sustainability competences of students and teachers in rural schools of the city of Mixco in Guatemala.

In this sense, the use of this methodology justifies and contextualizes the research in phase three of the Kemmis' action research model (1988) and in the social context framework in which the project is carried out, helping to generate space for reflection, a main aspect of the third phase of the model's organizational dimension: (1) Planning (action), (2) Action (retrospective guided by planning), (3) Observation (prospective for reflection), and (4) Reflection (retrospective regarding observation) [41].

On the basis of the foregoing, we can say that our research is systemic and controlled. In the first phase of our research we worked with a qualitative methodology, starting with the action research methodology that corresponds to a critical approach of educational research to resolve our research problem. The technique used to collect information for educational change and improvement was the self-reflexive spiral technique proposed by Kemmis and McTaggart (1988) by means of successive processes of reflection–planning–action–evaluation in each phase of the study [41]. In this sense, we have been able to work on the basis of the self-reflexive spiral of the methodological process of action research consisting of the following four moments or phases [39]:

1. Prepare a critically informed action plan;
2. Implement the plan, strategic action;
3. Observe the effects of the action;
4. Reflect on the effects as the basis for new planning.

On this basis, the model has been conceived as an uninterrupted spiral of phases involving the participants of the schools taking part in the study, and in a process of reflection and empirical

approach to reality by means of the content and materials of the visual literacy E.CO KIT, consisting of contemporary images representing man's influence on the environment. Moreover, the social character of the context in which the model is applied favours using the spiral cycle as the basic processing in order to obtain, through sessions of inquiry and reflection on images, observable results regarding the action [30].

Based on the methodological model described above, each one of the phases followed this study is listed below:

1. Planning: Having identified the problem and given the lack of resources of these rural schools, Visual Thinking was used as an innovative methodological tool to consider different actions geared at favouring social transformation and change. The objective of the research was, thus, to learn about the effects of visual literacy and visual thinking on the students in the acquisition of competences for sustainability with the E.CO teaching KIT and to observe possible differences between individuals.

2. Action: In this phase the VA.E project was implemented with the active participation of all students and from the perspective of attention to diversity. The participating teachers were in charge of implementing use of the ECO Kit in each classroom. This involved establishing a dialogue with students based on the observation and analysis of the templates used. Teachers used different formats to organize the groups, fomenting collaborative peer-work geared at proposing alternative solutions to the problems shown in each one of the images. In some cases, stories were created based on the graphics or drawings to express psychological, social, and cultural ideals and stereotypes in respect to each problem, giving rise to the dialogue and the action.

The implementation of this resource in the classrooms in Mixco, namely the tangible teaching material of the E.CO KIT, responded to a need, which in turn generated a distinguishing factor that enabled the compilation of the results. Likewise, the results indicate that visual resources are instruments that contribute to improve teaching-learning processes based on students' critical and creative reflexive thinking.

3. Observation: Faithful to the pillars of action research, the main research technique we used was participant observation, which enabled doing the research on site, in other words in the same place as the teaching exercise, and to obtain real information about the students and their perceptions during the learning processes [42].

Once the research process was over, the data was analyzed and interpreted by the research group and participating entities from a critical and reflexive perspective. Having obtained the initial results, sessions were held with the agents involved to exchange information for the purpose of making some changes and adjustments to improve the subsequent planning, application, and evaluation processes and enable a new phase of research.

4. Reflection: In respect to the process of evaluation and reflection regarding the results of the actions, and the analysis and understanding of situations, and on concluding the implementation and gathering of information and the analysis of these results, the VA.E team decided to assess the outcomes and main conclusions arising from the initial findings, which led to the documentation of recommendations and new objectives for a second phase of implementation or for future studies. This is specified in greater detail in this paper's conclusion section.

When the research process finished, the data was analyzed and interpreted from a critical and reflexive perspective by the research group and the participating entities. After obtaining the first results, the agents involved met in sessions to exchange information for the purpose of making changes and adjustments in order to improve the successive planning, application, and evaluation processes to carry out a new research phase.

5. Results

On the basis of the results obtained in the implementation of the project in the four schools, we can conclude that the study has permitted an objective assessment of the results, measuring the degree of involvement of teachers in the process of learning and acquisition of competences

for sustainability by students based on their cognitive and affective development and command of audio-visual and environmental contents. Hence, we can affirm that the didactic E.CO Kit is an effective teaching-learning instrument that contributes to improving cognitive development and environmental awareness, in addition to actively impacting the acquisition of sustainability competences.

As mentioned earlier, implementation of the E.CO teaching Kit in classrooms entailed additional prior training with the educator, which contributed to the acquisition, development, and consolidation of competences for sustainability that are necessary to contribute to improving those same competences amongst students. This enabled the educators to enhance their command of the contents, and consequently, of the dimensions of the E.CO Kit.

With the help of the teacher, students are motivated in the process of analysis and discovery of images through games, comprehension, assessment, and apprehension of the visual arts provided by the Kit. In addition, with the Kit students develop greater environmental awareness of, and cultural reconciliation with, other environments that differ from theirs through their own learning experience. They become the main characters of the process of creation of their own visual code, confirming that in this type of process, it is essential that schools commit themselves to the visual literacy of their students as a learning instrument. This was mainly due to the contents, activities, and common thread of the materials in the teaching Kit, as mentioned earlier in the paper. In this sense, both the main objective of the tools, which is “human influence on the environment”, and the nature and type of activities that are included in order to implement the methodology and understand the environment as a part and a source of learning, allow us to comprehend the process of acquisition of sustainability competences, as well as the impact it has on learning and personal development.

For students of Primary Education, the concepts of pollution, recycling, and the role of mankind in the protection of nature have enabled them to establish the connections between cause and effect through images (water, dumps, wild and marine animals, forest, floods, persons, and cities, amongst others). In this sense, and through one of the kit’s image games, the game of Trios (available in the E.CO Kit), students have been able to determine the problem, the cause, and the solution of the different situations described in the images, contributing to their competences for systematic thinking and for action, as well as the complex and international competences in the field of sustainable development.

In turn, dialogue regarding the protection of nature and importance of environmental education in schools promotes the development of critical thinking and resilience. By means of questions such as “What are we doing to help the survival of species?” and on the basis of the image of some animals in danger of extinction, students are capable of establishing relations and proposing different solutions to the problem from the perspective of collaborative work [17].

From the analysis by the 12 teachers involved in the training for teachers of the pedagogical material and the images associated with the VA.E. project, its implementation, and the study, it appears that the most noteworthy educational values of the E.CO Kit are respect for life and the environment, solidarity, teamwork, responsibility, tolerance, and organization. These values and capacities are directly related with the competences for solidarity, and can be the focus of complementary work from other perspectives and activities, such as a campaign for the adequate use of natural resources, fomenting responsible consumption, promoting health and personal hygiene, as well as any other activities of social commitment, such as the organization and cleaning of the community or school surroundings.

Due to the evidence of natural reality perceived through an analysis of the images, different aspects have been extracted from the teaching material that are more directly connected with learning values and educating for social and cultural diversity. In this sense, knowing the real situation of the surroundings and the society in which people live and the contrasts between different cities promotes amongst students an ethical and social commitment and resilience, clear components of competences, and a sense of responsibility towards present and future generations. This methodology, based on literacy and interpretation through Visual and Critical Thinking, enables students to visualize, learn, and imagine [43].

The use of observation-action as a mechanism of self-learning makes it possible to promote logical progress in the observation, applying comprehension and analysis of what is observed, seen, and interpreted. The rejection of images that are more violent or upsetting can also indicate aspects that differ from students' reality or that they do not accept, as victims of the concern regarding the situation of their surroundings. These indicators are evidence of the degree of command and performance students have over the action of persons and roles of the different agents in society. In consequence, on the basis of these data they can determine which elements they have built and destroyed on the planet, promoting a critical reflection on their part and the development of their creativity by proposing different solutions for these problems. These aspects have significant impact on the three dimensions of learning for sustainability: knowing and understanding (theoretical knowledge and comprehension); knowing how to act (practical and operational application of knowledge and values); and knowing how to be (the values and comprehension of others).

Through the observation of the responses and actions performed by the students and teachers, new lines of action in the pedagogical use of the E.CO Kit were proposed in respect to the development of the competences established for sustainability.

6. Discussion

The competences and capacities that students and teachers need in order to build societies characterized by sustainability require transversal educational strategies and training processes based on formal and informal educational activities [35].

As indicated by Murga, the most important element is to include the principles and values of sustainable development in teaching practices and in learning processes [6]. In this sense, the appropriate term in this type of learning process is "curricular sustainability", coined by Jucker and Mathar, given that it is not a question of educating about sustainable development, but rather educating for sustainable development, activating the behaviour that justifies this approach [42].

In the pedagogical and learning process regarding Education for Sustainable Development, as explained in the UNESCO report on the types of learning associated with the EDS, participatory and collaborative learning, learning based on problems, and critical thinking are the ones which facilitate achieving the objectives [19,20].

In this sense, the four perspectives proposed by UNESCO for a model of Education for Sustainable Development are: (1) Holistic (systemic competence or reflection), consisting of relational thinking and the feeling of belonging; (2) Contextual (collaborative decision making), consisting of argumentation or reasoning and democratic commitment to universal human rights; (3) Critique (critical analysis), consisting of intellectual and ethical commitment; (4) Transformative (sense of responsibility towards present and future generations), consisting of intellectual and ethical commitment, resilience, and responsibility, which are the qualities that are fomented through the E.CO Kit, due to the teaching content, the open nature of the activities, the enquiry model as the central concept of the proposal, and the participation of teachers in the teaching-learning process [6,44].

On the basis of the premise of including enquiry as the central concept of the projects and activities, the students can create their own compositions of images, make complex decisions, develop reasoning and working in groups, and develop an international and ethical awareness of the environmental problems of their surroundings, consequently having a direct influence on the acquisition of competences for sustainability [45,46].

At the present time, education, apart from contributing to the training and acquisition of competences and to the specialization of students, takes on a relevant role in society with the challenge of training citizens to transform the world [45]. UNESCO, in the "17 goals to transform our world" of the 2030 Agenda for Sustainable Development, states that the achievement of a quality education is the key element to improve people's lives and achieve sustainable development [2].

So far, there have been important advances related to access to education for all at all different levels. Because of this, and in order to actively contribute to this strategy, education should guarantee

that students acquire all the necessary theoretical and practical knowledge with the aim of boosting sustainable development. Among other things, it has to promote sustainable lifestyles, human rights, gender equality, the culture of peace and non-violence, world citizenship, and the value of cultural diversity, as well as the contribution of education to development [16].

In the document published by UNESCO in 2014 entitled *Global Citizenship Education: Preparing Learners for the Challenges of the Twenty-First Century*, global citizenship education (henceforth GCE) is advocated as a paradigm that can develop attitudes, knowledge, values, and social skills necessary for students to generate a setting that is socially responsible, fair, inclusive, and sustainable [46].

In this sense, the importance of GCE is linked to the acknowledgement of the value of education in order to understand and pursue global issues that affect the whole world in its social, political, cultural, economic, and environmental spheres. If social skills are developed at early ages, they lay the foundations for the potentialities of the future. Therefore, we can assert that skills are built upon previously developed skills [46].

In this regard, investment in education and skills comprises one of the key policies to address many present-day socioeconomic challenges, and to train future citizens who are committed and responsible toward the global society. In this sense, the teaching-learning process arbitrated by the VA.E Project has enabled training the capacities that enable, in association with the components promoting the development of the four perspectives of Education for Sustainable Development (EDS), the acquisition of competences in sustainability.

Visual thinking, or the construction of conceptual maps that facilitate relational thinking, critical thinking, argumentation, collaborative learning groups, and learning services, are key tools that act directly in the training process and that foment, in turn, the acquisition of knowledge and social commitment [32].

Consequently, within the framework of sustainable development, from a diverse and plural context and from the experience and implementation of VA.E in rural schools in Mixco, Guatemala, we can state that by redesigning teaching practices and these educational models, it is possible to contribute to a change in thinking and to the acquisition of competences.

7. Conclusions

As this study's final contribution, we can confirm the important role of intercultural education in the social sphere and the consequences it has on the image and process of present-day socialization of men and women.

Access to and knowledge of a diverse, globalized society from a plural perspective that enables understanding change is not an easy task, for teachers and students alike. For this reason it is essential to develop the true social and cultural education of the new generations, training persons capable of living together in a collaborative manner, sharing experiences and making decisions based on participation and a commitment to human rights and the Objectives for Sustainable Development (OSD).

Today's society has a global and plural profile due to the fact that we are undergoing constant change, both social and human. This change is closely related to the current economic, migration, and cultural exchange transformations. Within this context, education appears as a key tool for social cohesion, in addition to being the fundamental axis of knowledge and competence acquisition able to generate a sustainable society. Because of this, the results provided in UNESCO's report on *Education for All 2000–2015* must be considered in order to plan flexible education that can meet the needs of social, cultural, and educational diversity at an international level, making it possible to directly work on the competences for sustainable development through education [16].

The education of citizens geared at achieving a positive view concerning diversity and global society requires worldwide planning of new educational policies, both through dialogue and cultural exchanges and in support of human rights, human dignity, and social inclusion in educational contexts.

The development of VA.E as an innovative educational methodology in cooperation with institutions, public entities, and universities of the city of Mixco in Guatemala has provided certain relevance to the project in the educational and cultural sector, generating an impact and benefits for the research team, teachers, students, and the schools involved. This institutional involvement of both the public and private sectors has had a direct influence on the follow-up, analysis, and implementation of the project, given their educational and social character, together with their direct involvement in the management and administration of the educational sector in this region of Guatemala.

As a result of this study, based on the implementation of a methodology such as VA.E, which makes use of the educational potential and impact of images in learning, we can state that the E.CO Kit and Visual Thinking contribute to the visual literacy of children, to their cognitive, social, and emotional development, irrespective of their culture or territory, addressing competences in sustainability in the teaching-learning process from a critical, holistic, transformative, and contextual perspective [44].

With the analysis of the results obtained by means of the VA.E, it has been possible to carry out a scientific study of the social, cultural, and educational impact of the E.CO Kit in the classrooms of rural schools in the area of Mixco in Guatemala, and a study of the development of skills and abilities of students through the use of images.

In specific reference to this study's impact on learning and developing competences for sustainability, a note is made that teachers' active participation in planning and consolidating a model of Education for Sustainable Development (ESD) by means of the E.CO KIT was essential, given the pedagogical nature of the material and resources, being directly related to acquisition of knowledge, values, and skills.

Considering that the acquisition of competences in sustainability and the involvement of the agents in said acquisition in educational contexts must be a pedagogical priority, this will require the use of resources and tools, and the implementation of new learning strategies, that enable its development [44].

On the basis of the results of this study and in the framework of the research process of participatory action, we can conclude that it is important to consolidate a model of Education for Sustainable Development (ESD) by means of a teacher training plan for all levels of education and in all contexts that will promote this professional and entrepreneurial competence and the ability to transmit it in sustainable societies.

Creativity and the capacity to transform have a positive influence in dealing with social contexts characterized by sustainable development. In this sense, the E.CO Kit is an effective teaching-learning tool that contributes to improving students' visual literacy, creativity, and hence, their academic performance and motivation for learning. By means of the contents regarding human influence on the environment, cities, nature, and economic growth, together with the context in which the tool has been implemented, we confirm, on the basis of the results, that use of the E.CO Kit has a significant impact on the acquisition of competences for sustainability.

We consider that the implementation of this research process with a participatory and action approach provided added value to the initial project carried out in rural schools of Spain and Mexico, through the analysis of proposals to adapt the teaching kit to different educational levels and needs and the collective synergy of the agents involved, which is the fundamental basis to comply with and ensure the impact of the common international objectives of Education for Sustainable Development (ESD).

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