http://doi.org/10.17163/soph.n26.2019.06

Natural Sciences as an integrating knowledge

Las ciencias naturales como un saber integrador

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Abstract

The present article aims to analyze modern pedagogical trends and contribute with innovative methodologies in the teaching of the natural sciences area in order to enable lasting scientific knowledge through educational mediations embodied in integrative projects and creative classes. The study considers reflections of several researchers that support the integrative approach and interdisciplinarity; points of view that allow lasting, integral and holistic learning. These didactic conceptions allow us to value science as the only non-fractionated one. Therefore, the research starts from considerations of science, significant learning, innovative didactic guidelines for the classroom, and the role of the teacher against the taboo "the teacher teaches science or transmits science". To conclude, it is argued that this area corresponds to the factual sciences; that is, the discovery of science with experimental didactic proposals "learning by doing" that lead the student to enhance abilities, skills, and cognitive abilities in search of proven knowledge, as well as the study and management of the scientific method with its processes and techniques to adopt a scientific attitude before laws, principles and phenomena of nature.With this scenario, it is worth noting that the organization of knowledge in this area enables the defense of the environment to allow a just society with values and love for the ecosystem, strengthened in the paradigm of teaching man to live fully in a protected environment without contamination.

Keywords

Science, Natural Sciences, knowledge, pedagogical tendencies, teacher.

Suggested form of citing: Jaramillo Naranjo, Lilian Mercedes (2019). Natural Sciences as an integrating knowledge *Sophia, Colección de la Educación, 26*(1), pp. 193-214.

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Resumen

El presente artículo tiene como objetivo analizar las tendencias pedagógicas modernas y contribuir con metodologías innovadoras en la enseñanza aprendizaje del área de ciencias naturales a fin de posibilitar saberes científicos duraderos a través de mediaciones didácticas plasmadas en proyectos integradores y clases creativas. En el estudio se considera reflexiones de varios investigadores que sustentan el enfoque integrador y la interdisciplinaridad; puntos de vista que permiten aprendizajes duraderos, íntegros y holísticos. Estas concepciones didácticas permiten valorar a la ciencia como única más no fraccionada. Por lo expuesto, la investigación inicia desde consideraciones de ciencia, aprendizaje significativo, pautas innovadoras didácticas para el aula, y el rol del docente frente al tabú "el docente enseña ciencia o trasmite ciencia". Para concluir, se argumenta que esta área corresponde a las ciencias fácticas; es decir, al descubrimiento de la ciencia con propuestas didácticas experimentales "aprender haciendo" que lleven al estudiante a potenciar habilidades, destrezas, y capacidades cognitivas en busca de saberes comprobados. Asimismo, comprende el estudio y el manejo del método científico con sus procesos y técnicas para adoptar una actitud científica ante leyes, principios y fenómenos de la naturaleza. Frente a este escenario cabe resaltar que la organización del conocimiento de esta área posibilita la defensa del medio ambiente para permitir una sociedad justa con valores y amor al ecosistema, fortalecido en el paradigma de enseñar al hombre a vivir con plenitud en un medio protegido y sin contaminación.

Palabras clave

Ciencia, Ciencias Naturales, saberes, tendencias pedagógicas, docente.

Introduction

This article implies reflecting on the contemporary pedagogical innovations that are required in recent times to be applied in modern pedagogical spaces. In this case, the natural sciences consolidate a scenario of factual or experimental sciences, whose teaching-learning process is to discover knowledge through the testing of theories and propose critical argumentation in new knowledge with more integral and integrating approaches to reality.

In this part it is necessary to point out that by working with integral approaches and relating constructs between life sciences, earth sciences and physicochemical sciences in the pedagogical processes, we obtain integral learning, an approach that discards the traditional models that favor the partialization of knowledge. It also aims to reflect on pedagogical trends raised by various authors on integrative projects and creative classes, whose purpose is to contribute innovative proposals that enable pedagogical approaches with new scenarios and renewed and creative learning environments.

On the other hand, the modern curriculum has a focus in which emphasis is given to the "protagonism of the students", that is, it allows to enhance cognitive and metacognitive skills in the teaching-learning processes. And since classrooms are spaces or pedagogical scenarios, the area

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 193-214.

of natural sciences contributes to the construction of new knowledge in a meaningful and integrated way, in order to ensure new theoretical and practical knowledge that contributes to a modern education.

This article is divided into three parts, in the first one the theoretical foundations of science, the natural sciences and the integrative approach are presented. In the second one we reflect on the significant learning considering the theory of David P. Ausubel, then we reflect on the natural sciences as a contribution to research, likewise innovative guidelines in pedagogical mediation related to the role of the student will be addressed. All these conceptual attributes contribute to reflect on "the teacher teaches science or replicates science". And, in the third part, some abstractions reflected in the conclusions are explained.

The considerations raised here respond to the personal perception of the researcher based on authors such as: David P. Ausubel (1963), Dale Schunk (2012), Luz Rodríguez (2010), Augusto Bernal (2010), and José González (2015), main researchers of topics on: significant learning, integrative learning, natural sciences as an area that promotes research from educational settings, and creative classes. Based on these considerations, modern pedagogical alternatives will be promoted, whose purpose is to contribute with new points of view for education and promote lasting and significant knowledge through modern pedagogical projects that promote new ways of teaching and learning based on *integral approaches and creative classes*.

Based on the previous discussions, the development of the proposed topics is presented.

Introductory postulates on science

It is important to highlight that science is conceived as an attitude of respect for human life, as highlighted by Augusto Bernal (2010) when he says that "science is one of the greatest achievements of humanity, and can be used constructively for the service of the human being" (p. 19), in this reality science is responsible for seeking knowledge through concepts related to each area of knowledge, but this knowledge as Bernal (2010) indicates must be at the service of humanity in constructive fashion to contribute to the improvement of the living conditions of each person.

Therefore, it is important to emphasize that teachers strive to teach knowledge that will serve them for life, respecting different realities and ways of life related to each of the contexts: such as culture, autonomy

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 193-214.

and identity. However, it is appropriate to cite postulates related to the epistemology term that is associated with science. In this regard Germán Parra (2000), states: "in a stricter sense, epistemology, means the logic of science, as soon as science is conceived as something structured and systematic" (p.10).

Also, Hugo Cerda (1998) states when he points out that:

> Epistemology is considered as that philosophy or theory of science that critically studies the principles, hypotheses, and results of the various sciences, with the purpose of determining their origin and structure, their value and their objective scope (p. 42)

Therefore, the harmonization of the theory of knowledge in the educational context involves articulating theoretical approaches that enhance scientific research in students, to provoke in them the curiosity, inquiry and verification of knowledge as a product of the logical significance of knowledge to be applied to new significant realities, with the possibility of being transferred to diverse realities depending on the culture and identity. In the same way, extrapolation will be seen in its entirety when the students complete the educational training whose productive knowledge will be reflected in their working life.

Based on these considerations, it is appropriate to mention the following:

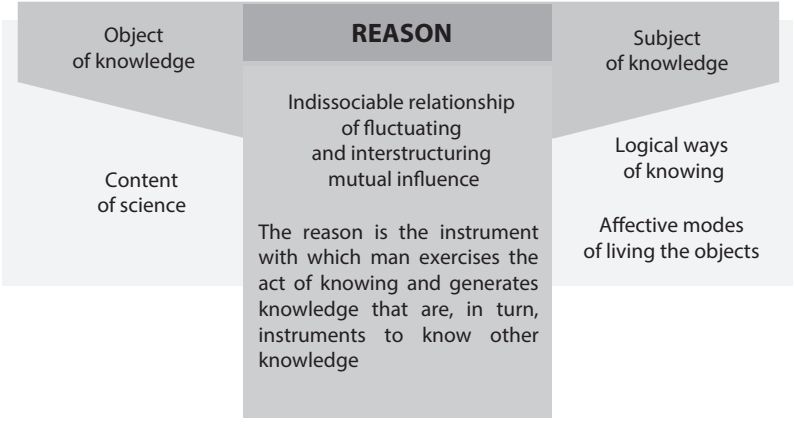
> The purpose of an epistemology of professional practice is to reveal this knowledge, to understand how it is integrated specifically in the tasks of professionals and how they incorporate, produce, use, apply and transform according to the limits and resources inherent in their work activities (Tardif, 2004, p. 189).

According to Tardif (2004) the production of knowledge is transferred in the educational praxis, and at the same time, it is related to professional practice, that is, knowledge is applied from practice to theory and from theory to practice, in order to contextualize significant situations that serve the student's life; therefore, teachers will be looking for alternatives of pedagogical mediation so that these discovered and contextualized knowledge are complements for the new knowledge society. Therefore, it is important to systematize what is indicated. Figure 1 shows the synthesis of scientific knowledge, where the object of knowledge is related to the content of science, and scientific knowledge is related to reason as an attribute of the man who exercises the act of knowing, the same that generates knowledge as the instruments to know other knowl-

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 193-214.

edge. In short, the subject of knowledge are the logical ways of knowing and the affective ways of living the objects, and what is sought is that the discovered knowledge adapts to diverse realities respecting the culture and identity of each of the contexts.

Figure 1
Synthesis knowing about knowledge



Source: Adaptation made by the researcher from Daros (2010)

For Piaget, cited by Augusto Bernal (2006) in the book Methodology of Research, logic, methodology and theory of knowledge, or epistemology, constitute three important branches in the field of scientific knowledge: Logic is the study of the formal conditions of truth in the field of science; methodology is the theory of general research procedures that describe the characteristics adopted by the general process of scientific knowledge and the stages in which this process is divided, from the point of view of its production and the conditions from which it must be made (p. 23).

These contributions of Bernal (2006) are significant when emphasizing that "logic, methodology and the theory of knowledge or epistemology", constitute three important branches in the field of scientific knowledge, hence the relevance of the natural sciences for the discovery of knowledge, didactic situation that highlights the way of teaching through observation, experimentation and scientific research, in which skills and abilities are enhanced that contribute to the productive source to form critical and participatory human beings mediated by the discovery of science.

Sophia 26: 2019.

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 193-214.

In this sense, this area should allow creative innovations linked to the scientific knowledge of science in the students, therefore, the mediators of learning should apply teachings with didactic strategies that promote meaningful and integral learning, to guide the students to build science from their own concepts framed in integrative projects. In this same order of ideas, it is relevant to quote Aguilar (2012):

> In "The eternal loneliness of knowledge", Sara Wood believes that knowledge makes a cross section in the reality of human beings, generating a new relationship that is no longer at the same level of 'subjects', but a 'subject' that names, which selects and from an 'other' or 'object' that is named. In this field, the question arises about knowing, its possibilities, flaws and impossibilities. The author argues that knowledge will continue in its eternal loneliness if only limited to be a general database, accurate and objective, if it fails to return to enter the human subject. Emphasizes the need to create and use a transdisciplinary language that allows the disciplines to remember about their genesis and about the true purpose of their searches (p.20).

It means, then, that the constructed knowledge must be socialized in integrative projects associated with other areas of knowledge in which several areas of knowledge are inserted, turning this knowledge into interdisciplinary and transdisciplinary projects, so that the learned knowledge does not remain only in biased and individualized knowledge. That is to say, the "knowing, knowing how to do and know how to undertake" associated and integrated with areas of the curriculum enhances true constructivist and meaningful education.

Ultimately it is essential that teachers who teach the area of natural sciences apply meaningful and constructivist methodologies in the teaching and learning processes situations that encourage the new citizen of the XXI century to anchor the knowledge in new effective and productive situations, without losing sight the fact that scientific and technological development experienced by the human being in recent decades has allowed man to project himself into the future and face new challenges. In this same order of ideas and based on the considerations raised, it is relevant to deepen into natural sciences and their relationship with integrative learning.

Natural sciences and integrative learning

In order to consider aspects relevant to the natural sciences, it is important to highlight scientific situations that are related to the wonderful

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 193-214.

rapid change that has taken place in the world of science, where extraordinary experiments have occurred so the author (2007) in *Natural Sciences Didactics* says:

> Science has scientific and technological advances such as radioactivity, discovery of new atomic particles, the study of quantum mechanics, electron and electronics, space travel, computing, cybernetics, satellite information, genetics, molecular biology, cloning, and the human genome (p.28).

Consequently, science has evolved rapidly, its discoveries have shown that there are scientists who, based on proven knowledge, are demonstrating to the world more and more impressive scientific and technological advances.

On the other hand, it is known that science is the true knowledge of things, while other authors point out that it is a systematized set of truthful and proven knowledge that contribute to conceptualize new knowledge, that is why when learning natural sciences considers true and proven knowledge to promote lasting and integral learning, scenarios that will favor meaningful and productive learning in a modern context.

In the same way José Cegarra (2004) states:

> We call science the set of certain knowledge of things by their principles and causes; therefore (...) it is true knowledge and in any case the objective of science is the search for truth (p .6).

Within this order of ideas it is clear that teachers will incorporate into the teaching of students' knowledge related to updated science in order to rescue proven knowledge that potentiate knowledge that helps to validate scientific truth and also to realize the constructivist criticism; from these truths rethink new ideas as stipulated by Popper (1997) cited by César Bernal (2006) in Research Methodology when he states that "science is a permanent revolution and rational criticism [...] therefore science is in permanent self-criticism" (p. 39). Then the thought of Popper (1997) is the reference that allows teachers to dedicate themselves to request students to critique knowledge and enable the construction of new knowledge in order to contribute to critical thinking through the discovery of scientific truth.

Based on the previous approaches, we must not fail to highlight the position of other thinkers who investigated the area of natural sciences, as affirmed by Andrés Cabrerizo (2005) when he states:

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 193-214.

> The Natural Sciences belong to the factual sciences because they are based on the facts, on the experimental and material, therefore, they are those that in their research act on the reality. In the first place, observing the processes and events that modify its functioning and making conjectures, that is, proposing hypotheses that must be proven [...] these factual sciences are divided into: Natural: *they center around nature, physics, chemistry, biology, geology, individual psychology, etc.* [...] Factual sciences resort to observation, and to experiment and to prove or verify (confirm or not) hypotheses that are initially provisional until the final verification (p.1).

Based on the reasoning, this area proposes integral pedagogical alternatives, in order to enable articulated learning between life sciences, earth sciences and chemical physical sciences in order to project oneself to a modern teaching and not only be consumers of the curriculum in rigid and fractional form, these innovative contemporary proposals allow to train students with integrating and critical knowledge.

Next, an example of *integrative learning*, taken from Dale H. Schunk (2012), which invites reflection and application according to the context.

Reading: Constructivism and integrative learning

This type of learning recommends an integrated curriculum and requires teachers to use the materials in a way that students actively participate. Professor Kathy Stone applies several constructivist ideas with her group of students and uses integrated units in the didactic work. During fall she teaches a unit on pumpkins. In Social Sciences they learn where pumpkins are grown, and the products made with them. She takes the group out to a pumpkin patch, where students learn how to grow them. Each student chooses a pumpkin and takes it to the classroom. In math class, students measure them and calculate how much they weigh; then they draw a group graph in which they compare the size, weight, shape, and color. They also calculate the number of seeds. In art classes they design a shape and, with the help of the teacher, sculpt it on their pumpkin. For the literature class they write a story and a thank you letter for the owner of the garden.

Source: Adaptation made by the researcher from Schunk (2012).

Reflection

With this integrative teaching model focused on the interdisciplinarity that Schunk (2012) shows, he emphasizes that after teaching knowledge

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 193-214.

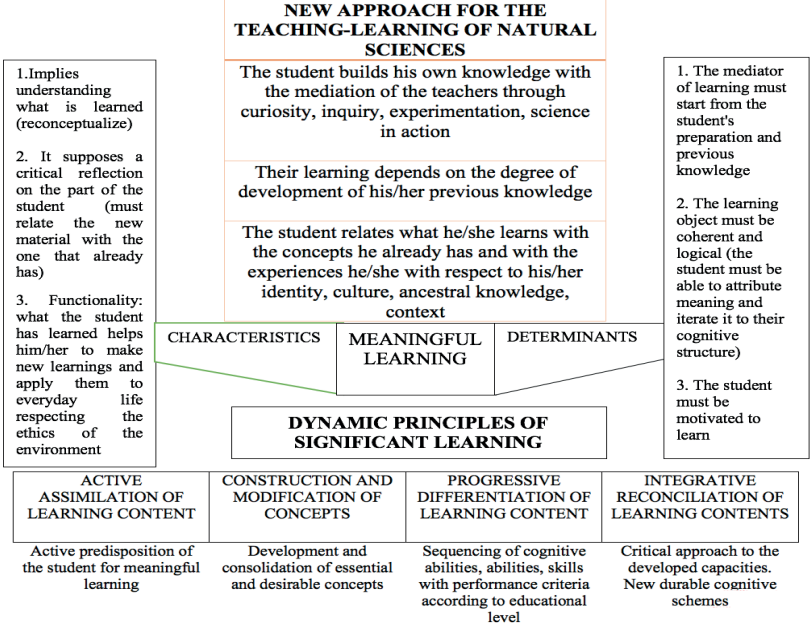
of all the areas it is important to think that in order to reinforce the built knowledge, one must work on interdisciplinary integrative projects whose knowledge is related according to contexts and needs of the environment.

Therefore, it is necessary and appropriate to point out that the area of natural sciences should also be inclined to mediate learning with innovative didactic methodologies such as integrative projects, these organizations working in modern educational scenarios aim to provide the student with a globalizing and critical thinking that will allow them to understand the world and to better assess the complex realities in which the parties acquire meaning only within the framework of the total reality. These pedagogical mediations enhance meaningful and functional learning. Next, the benefits of meaningful learning.

Meaningful learning

The following figure explains the characteristics of meaningful learning and the benefits obtained in learning processes.

Figure 2
Meaningful learning



Source: Adaptation made by the researcher from Rodríguez (2010).

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 193-214.

Figure 2 tells us that significant learning is done when it is taught with integrative learning and creative classes so that knowledge is durable and new cognitive schemes are formed, that is, it is considered in the educational practice the previous learning experiences of the students implying an understanding of what was learned in previous classes, then they are related to a critical reflection of what they learned and subsequently related to new knowledge, which have functionality of what the student has learned, whose knowledge is useful for new learnings with a deep critical sense and respecting the ethics of the environment.

The objective is for the learner to build their own knowledge with the mediation of teachers through curiosity inquiry, experimentation and science in action, learning depends on the degree of development of prior knowledge, and this in turn favors the new learning. Therefore, when integrative projects are applied, the student relates the developed projects that are at the same time durable strategies for the understanding of knowledge that then relates them to the new concepts as well as respecting identity, culture, ancestral knowledge and context.

Therefore, it is important to point out that this area contributes significantly to the research since the knowledge to be developed requires starting with the exploration of knowledge, where through innovative pedagogical mediations it is intended that students explore and discover science, situation that will allow them to become researchers of their learning. Next, the research scenario.

The natural sciences as a contribution to research

Scientific research is a research space for teachers and students who participate in teaching and learning processes, whose purpose is to pay tribute to science in a practical, experimental and meaningful way and insert methodological guidelines to get students, who have the skills to investigate from the first years until higher education, this way you will get learning that is aligned with the discovery of facts, principles and phenomena.

> In essence, research seeks knowledge of the truth (...) research is a creative process through which human intelligence seeks new values. Its purpose is to enrich the different knowledge of man, provoking events that speak to him of the reasons for things, penetrating the background of them with an exploratory mentality of new knowledge (Cegarra, 2004, p.41).

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 193-214.

Likewise, J.W. Besth quoted by Mario Tamayo (2004) highlights that:

> We consider research as the most formal, systematic and intensive process of carrying out the scientific method of analysis. It includes a more systematic research structure, which usually leads to a kind of formal review of the procedures and a report of the results or conclusions. While it is possible to use the scientific spirit without research, it would be impossible to undertake a thorough investigation without employing a scientific method and spirit (p.38).

Therefore, it is important to point out that research being a more formal, methodical and intensive process to carry out, the procedures of the scientific method constantly seeks to rediscover new scientific innovations in order to discover other theories that strengthen new contributions to improve life through the discovery of science. Situation that should contribute to diverse forms of thought, respecting ethics and moral values, without aspiring to experience situations and aspirations that devalue humanity.

> The scientific fact plays an important role in the knowledge process. It is the result of investigations and serves as a starting point for the elaboration of theories allowing the confirmation or refutation of the hypothesis. It is precisely this function that turns the process of obtaining facts into a strict and rigorous process [...] and is obtained from an observation, an experiment or a statistical summary of a phenomenon or group of real phenomena (Díaz, 2006, p. 79).

Therefore, it is required that the area of natural sciences be a science that contributes to the discovery of facts and phenomena through experimentation, whose pedagogical ecosystem is the laboratories of natural sciences, biology, physics and chemistry.

Therefore, it is prone to the discovery of science through experiments, whose purpose is to think that the discovery of science is essential for durable learning strengthened in meaningful and proactive learning. Therefore, this area contributes to the gap between traditional education and teaching through comprehensive knowledge and research, this academic organization will benefit new scenarios linked to interdisciplinarity and pedagogical innovation with a new look towards a modern learning scenario to improve the educational quality.

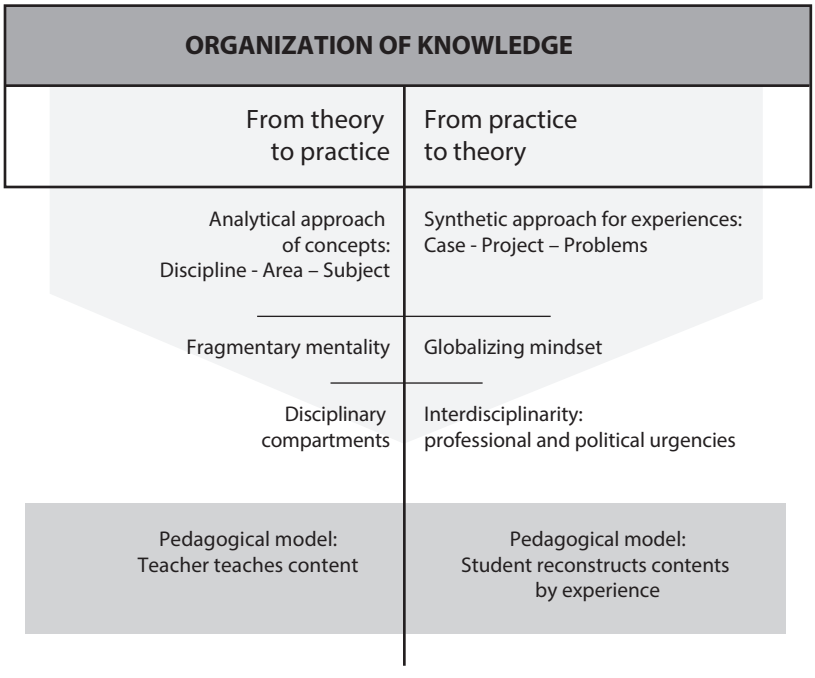
Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 193-214.

Innovative methodological guidelines for teaching and learning natural sciences

In the teaching and learning processes of the study area it is important to highlight two types of innovative pedagogical methodologies, these are: 1) Integrative projects, and 2) Creative classes.

However, it is important to start by visualizing Figure 3 in which two approaches differ: 1) From theory to practice, and 2) From practice to theory. The same ones that lead us to distinguish benefits of a traditional learning, as well as integrating projects and creative classes.

Figure 3
Organization of knowledge according to two approaches



Source: Izurieta, 2015, p. 41

These two groups of learning have great differences when *speaking from theory to practice*, it is visualized that learning is disciplinary, an order of subjects is respected, and knowledge is departmentalized.

On the other hand, when speaking from practice to theory, the systemic organization of the knowledge that leads students to an integral formation is enhanced, the application of this synthetic alternative crite-

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 193-214.

rion promotes the interrelation of different aspects of the same discipline or with the rest of disciplines, interdisciplinarity also tends to train students with a globalizing mindset of knowledge.

However, it is important to point out that in order to contribute to this type of integral learning, it is important to indicate that it is strengthened more when considering constructivist guidelines. In this regard Klinger and Badillo (2000) express that:

> Constructivism must build knowledge by itself, and with the help of another (mediator) and can only learn elements that are connected to knowledge, experiences or conceptualizations previously acquired by him. What the student learns is not a copy of what he sees around him, but the result of his own thinking and reasoning, as well as of his affective world [...] then the teacher asks, guides, leads, does not teach reaffirming that the student is the central element (p. 8).

These approaches reaffirm that the integrative projects are the foundations of constructivism, where the student builds the knowledge itself with the help of the teacher, hence the word "mediator of learning" whose purpose is to seek the best learning as a result of the new knowledge. In short, what the student learns is not a copy of what he observes around him, but the result of "his own knowledge", at the same time he enhances more productive skills and abilities, highlighting the protagonism of the student when he "learns doing".

Reflection on the protagonism of the student

Jim Marshall incorporates personalized interactive strategies in micro curricular planning to enhance the interest of students. He uses directed observations, requests for presentations on the integrating projects created on air, soil, land and life, incorporates films, representations of previous works in open houses, awards obtained in national and international contests, because he does not want his students to limit themselves to memorize the content, he also seeks to develop critical and globalizing thinking in them because it includes didactic index cards in the student's learning to build their ideas. For this reason, he uses as an example a part of the integrating project related to the "germination of the seed" and includes key questions such as: what happened with the bean seed, how long it took to germinate the seed, when did the leaves came out, what happened with the root, what did first emerged from the seed, how much did the small plate measure at the end of the germination, that is, he asks

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 193-214.

according to the research tasks of each one of them. These questions are done to strengthen the curiosity for research, then forms collaborative work groups with inclusive groups, that is, respects the ethnic and socio-economic groups.

Source: Adaptation made by the researcher from Schunk (2012)

Reflection

Based on the example the teacher-tutor teaches students to learn "science doing", this means that students learn better when they explore, experience, infer, deduct their learning environments instead of listening passively to their teachers. Therefore, it is pedagogical to include individual and collaborative activities through learning cards, thus the teacher transforming in tutor and facilitator of knowledge for the new and modern education.

This makes us suppose that by fostering innovative teaching and learning processes, we can perfect integral knowledge. Likewise, with the aim of contributing to these contemporary methodologies, it is pertinent to consider creative classes in the didactic processes.

Creative Class

The creative class has several pedagogical qualities and is applied in the pedagogical practice to obtain optimal results of its students. It consists of promoting potentials and capacities of compression, analysis and synthesis, and in the pedagogical mediation modern innovative interactive strategies are included among which ICT are highlighted. From this perspective, this type of creative class contributes for students to learn with knowledge related to a whole. Regarding this innovative environment, María Teresa Esquivias (2004) indicates that:

> The creative process is one of the highest and most complex potentialities of human beings, this implies thinking skills that allow to integrate the least complicated cognitive processes, even those known as superior for the achievement of a new idea or thought (p.3).

According to this logic, it could be said that the creative classes strengthen several learning scenarios, with the purpose of significantly stimulating the skills and competences of the students, whose result will

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 193-214.

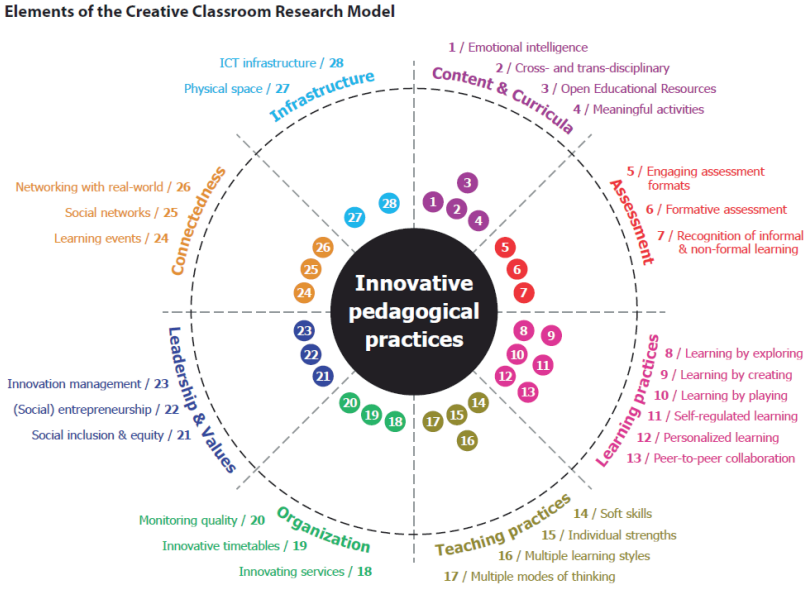
be to contribute to improving learning achievements from various pedagogical scenarios.

Given this approach Esteban Almudena (2010) highlights that:

> The concept of creative class transgresses the boundaries of the classroom as we have known them, creating an ecosystem of learning that seeks the renovation of educational practices using ICT. It provides students with not only the knowledge, but also the skills necessary to develop and participate in our current society taking advantage of the potential of technologies (p.1).

Likewise, the creative class is another significant proposal for the area of Natural Sciences: Figure 4 shows the characteristics that are enhanced when working with this type of learning.

Figure 4
Elements that make up the creative class



Source: González, 2015, p.2 (https://goo.gl/oqrd6N)

As we can see on the previous figure, it is observed that the creative classes are aligned with innovative pedagogical practices, and various administrative and pedagogical attributes are strengthened, such as: contents and curriculum (when speaking of knowledge and planning),

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 193-214.

evaluation (student training process), learning practices (practical theoretical strategies and theoretical practices), leadership and values (learning for life), and ICT (knowledge society). Among these relevant aspects it is highlighted that for the teaching and learning process several organized aspects are included in order to obtain true lessons learned in the knowledge society.

Creative learning environments for Natural Sciences

Among the various pedagogical activities that enhance the creativity and innovation of knowledge in students we can find:

- Raising contextual problems to students related to life, earth or physicochemical sciences.
- Contextualize contents of the curriculum according to the needs of the students.
- Evaluate learning according to the context of teaching.
- Employ strategies for the discovery of scientific knowledge.
- Apply the experimental process in learning scenarios.
- According to knowledge scenarios, apply problem-based learning (PBL) activities.
- Employ autonomous and collaborative learning.
- Discussions and debates.
- Use ICT in all learning scenarios.

With this series of innovative benefits, it is important to reflect on: What is the role of the teacher? Does he teach science or replicates science? These unknowns will clarify from several pedagogical perspectives the role played by the teacher in front of students and consider the possibility that teachers fulfill the effective role for their students whose final objective is to obtain valid knowledge in order to contribute to modern society.

What is the role of the teacher? Does he teach science or replicates science?

Teachers, when undertaking a pedagogical tour of daily activities in educational settings, have the mission of imparting science, which means that in order to create and build science, it is necessary to follow scientific life models of great figures of researchers, who inspire and awaken the

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 193-214.

investigative spirit in all their areas. In this way the teachers know, applies and experiences new knowledge together with their students through scientific-pedagogical tools, which, added to their research experience, constitute the relevant inputs so that they learn to create and cultivate science from the various educational instances. Therefore, in the journal *Altablero El sentido de educacar y el oficcio docente*, Ministry of National Education of Colombia (2005), highlights the following:

> The teacher of the 21st century is a citizen educator, able to read the local and global contexts that surround him and to respond to the challenges of his time. He is a facilitator who has domain over his discipline and who, through active methodologies, offers the necessary tools for students to understand the world from different languages, learn to live with others and be productive. The Educational Revolution is aware of these needs and the demands that this vision has for the educational institution (p.1).

With this contribution there are basic skills that teachers have for the construction of sciences, in short, potentiate significant learning by becoming a facilitator, because after knowing science, he looks, in the pedagogical classroom, for the strategy that will allow the construction of science through individual and collaborative learning. Here, active research methodologies are put at stake, whose objective are to seek and reconstruct science together with the students and to contribute significantly with valid knowledge in situations that society and the current world require.

Hence the importance of forming human beings through the discovery of science and respond to the demands of modern society. So, we would say that educators' interest is based on the new paradigms of research and society for the substantive search for solutions that allow responding to current needs and context, with new contributions emerging from the different academic areas. In this premise, the teacher is the one who aims to build and contribute knowledge and scientific knowledge to face effectively and human dignity the practical problems of globalized humanity.

In this regard Kohan and Waskman (2000) mention:

> What is it to be a teacher today? To be a teacher today is to live intensely your time, to live together; is to have awareness and sensitivity. You cannot imagine a future for humanity without educators. They not only transform information into knowledge and into critical consciousness, they also form people [...] they are the true "lovers of wisdom", the philosophers that Socrates told us about (page 32).

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 193-214.

Therefore, the teacher will apply individual and collaborative didactic strategies towards the understanding of knowledge, towards collaborative work, towards living in harmony among the members of the classroom, and toward respect between all, then these techniques will be integrals and creatives who articulate the different knowledge towards the social strata, and thus contribute towards the construction and reconstruction of science, which will allow to contextualize the new knowledge and obtain new meanings anchored to the social practice and to coexisting. In short, what is intended is that teachers expand their pedagogical perspectives to teach science for the benefit of modern society.

The teacher teaches how to build science

When starting this part, it is relevant to point out that teachers from the pedagogical mediation select didactic strategies for different areas of knowledge, with the purpose of applying them in the learning scenarios, which leads to the teacher teaching science or replicating science.

In this respect, Romero (2007) states that:

> The report to UNESCO of the International Commission on Education for the 21st Century (Delors, 1996) establishes the four pillars of education of the future that will be the pillars of knowledge: learning to know, learning to do, learning to live together, and learn to be. "Learning to learn" because it is no longer about transmitting knowledge, but the ability to learn processes [...] "learning to live together" because the process of social and cultural construction cannot be individual and exclusive but is centered on the achievement of plural identities (p.104).

Jaques Delors (1996) pointed out "The four pillars of education" (pp. 91-103) recognizing the value that the teacher has regarding the pillars of knowledge: "learning to know" stands out where the teacher applies the relevant strategy for students to investigate, discover and experience science. "Learning to do", when the teacher empowers students with cognitive, psychomotor or affective abilities and skills. "Learning to live together", and "learning to be", in the sense of sharing and learning while living in a community of knowledge. These theoretical approaches constitute a significant contribution for teachers, when they apply and articulate with integral methodological strategies, languages, experiences, abilities, investigative models, which seek resolution of problems respecting beliefs, visions, values, emotions and attitudes of the students for their context. However, it should be noted that by applying these pillars

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 193-214.

in educational settings, students take advantage of initial learning situations that are often innate and contribute to the initiation of meaningful learning, which after mediating with integral learning are often converted in skills and enduring capacities that enhance integrative learning, then Chart 1, which summarizes this:

Chart 1
Innate and Acquired Abilities of the Student

Innate and acquired abilities of the student	Teacher-mediated student-specific skills
1. High perception of the natural environment, built as a means of learning and application of capabilities and appropriate methods of on-site discovery	1. Take advantage of scenarios and contexts for research based on pedagogical learning spaces such as classrooms, laboratories, museums, libraries, sports courts, natural resources, among others, in order to achieve ventures to create and build science.
2. Application of natural language, visual, ludic, written and in other forms of symbolic representations for obtaining data through direct observation of the object or subject of research.	2. Employ direct observation, to extract previous knowledge and relate to new knowledge, a situation that will strengthen research and the transfer of knowledge.
3. Produce valid inferences from premises, using systems of critical, reflexive reasoning in the construction of meanings of those observed and experienced	3. Delucidate with logical sense the perceptions, experiences, emotions and attitudes of the subjects and objects investigated to guide processes of contextualization of knowledge at a social, political, cultural and anthropological level in relation to the ontological nature of its students and its ambits.
4. Build concepts, meanings through reflective, practical and theoretical dynamics emerged from their own criteria.	4. Take advantage of the knowledge acquired to apply and define interactive strategies that involve the critical-investigative spirit in the compression and creation of science in all its meaning.
5. Have a sense of global responsibility in the use of technology as a substantive contribution to their life in general	5. Design, transfer and use responsible technology to support educational processes, mainly in the transference and knowledge sharing in projects in sustainable living.
6. Interacting in a synergetic, harmonic and solidarity-conscious way with other people, preserving autonomy, self-determination and practical sense in socio-affective cooperation.	6. Interact with social groups, to facilitate the development of their autonomy and participatory democracy in the development of investigative attitudes, practicing ethic and moral values between the coexistence of local and scientific knowledge, respect for the cultural identity and human forms of diverse behavior.

Source: Adaptation made by the researcher from Montenegro (2007).

Sophia 26: 2019.

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 193-214.

Conclusions

After the investigative process, the article analyzes modern pedagogical theories about Natural Sciences as an integrating knowledge, allows reflection to mediators of learning about pedagogical strategies that are applied from the educational practice in several scenarios of knowledge, whose purpose is to contribute to the modern trends according to scientific advances, in this case, throughout the investigation we have reflected on the *integrative learning and creative classe*s, the same ones that constitute innovative approaches to articulate holistic and integral knowledge, and see the possibility of eliminating the pedagogical classes fractioned whose result is a biased learning among subjects of knowledge.

It is also suggested that for modern theoretical approaches we must start with renewed didactic mediations that promote scientific research in students, to provoke in them curiosity, inquiry and verification of knowledge as a product of the logical significance of knowledge to be applied to new diverse realities respecting the culture and identity, whose aim is to empower students for exploration of their the surroundings and scientific reality, so that they are able to produce knowledge in integrating projects by relating knowledge within the researched area and transferring knowledge with other sciences of the curriculum to provoke integrity learning, these benefits will strengthen "a whole of science" whose dimensions will be evidenced in lasting and significant learning.

For this reason, it is essential that the learning environments and environments should be constituted as pedagogical means to dynamize academic processes focused on the integrality of knowledge and produce lasting knowledge, these pedagogical innovations will enable interventions that ensure educational quality.

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Date of receipt of document: March 6, 2018
Date of document review: May 20, 2018
Date of document approval: June 22, 2018
Date of publication of the document: January 15, 2019

Sophia 26: 2019.

Print ISSN: 1390-3861 / Electronic ISSN: 1390-8626, pp. 193-214.