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SUSTAINABLE DEVELOPMENT FOR DESIGN EDUCATION

Desarrollo sostenible para la educación en diseño

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Abstract: Changes in human beings' values, attitudes and consumption patterns have severely affected territories that had traditionally occupied a sustainable space in society, with care and education being fundamental spaces for conservation.
In addition to the theoretical space, the objective of designers' academic competences include the development of project skills and learning the discipline's own actions, which is why education for sustainable design implies identifying and formulating problems described from environmental and disciplinary perspectives, venturing into cross-cutting areas and sustainable topics applied to the proposed training project, coupled with the inclusion of elements that allow incorporating working realities into future scenarios.

Keywords: Sustainable design, education, industrial design, design labs, eco design.

Resumen: El cambio en los valores, actitudes y patrones de consumo de los seres humanos ha afectado severamente los territorios que tradicionalmente ocupaban un espacio sostenible en la sociedad, siendo el cuidado y la educación un espacio fundamental para la conservación.
Las competencias académicas de los diseñadores tienen como objetivo, además del espacio teórico, el desarrollo de habilidades proyectuales y aprendizaje en el actuar propio de la disciplina, razón por la que educación en diseño para la sostenibilidad implica identificar y formular problemas descritos desde las bases ambientales y disciplinares, incursionando en áreas transversales y en temáticas sostenibles aplicadas al proyecto formativo propuesto, aunado a la inclusión de elementos que permitan incorporar las realidades laborales para escenarios futuros.

Palabras clave: Diseño sostenible, educación, diseño industrial, laboratorios de diseño, ecodiseño.

INTRODUCTION

Countries are uniting to pursue sustainable development following the framework of the World Commission on Environment and Development: «...satisfying the needs of today's generation without compromising the capacity of future generations to satisfy their own needs» («*Our Common Future*» Report, 1987, World Commission on Environment and Development). In conjunction with the 2030 Agenda for Sustainable Development Goals, section 4.7, which includes education for sustainable development and global citizenship (UNESCO, 2012, p. 9).

UNESCO's vision for 2030 is clear in terms of the SDGs (Sustainable Development Goals) concerning education, this is why it has granted relevant space to education and global citizenship in order to achieve

sustainable development. This has brought together holistic aspects of social and natural transformation and inclusion. Education must be a global project that focuses on fulfilling these seventeen goals and that unites forces against poverty, so that every effort is aimed towards development and education and is based on contemporary proposals of pedagogy and education.

Education for sustainable development intends to create a better tomorrow for everyone, with education being the main factor to achieve equity, peace and equality. Improvement at worldwide level must include an evaluation of statuses and deficiencies, as well as how to quantify development in order for it to be global and to encompass the largest amount of people. The scope of training for sustainable design comprises different elements of the study plans which might contribute to a sustainable future (UNESCO, 2012, p. 8).

These factors need to be interiorized by the academia. The discipline of design must be liable and build a design space for sustainability, one that permeates to educational scenarios in Latin America -grounded on outdated and obsolete settings- where components, form and function are driven by industrial production rooted in traditional economies, which for decades have benefited oil industries by choosing it as its raw material.

This is how exponential growth necessarily arrives at a point in which supply exceeds genuine or forced demand capacity. More often than not, this point comes a lot sooner than another that is even more dramatic: the moment in which the supply's natural limit is reached (Bauman, 2013, p. 61).

Understanding that industrial products' production processes have a major impact on the planet is crucial, said processes are environmentally managed through product's life-cycle assessments (Ahmad, Wong, Tseng, & Wong, 2018; Reuter & Reiter, 2019); these provide designers a glimpse into how each construction stage will affect the environment, but mostly into how to manufacture, implement and assess projects that improve materialization conditions of more environmentally-friendly proposals (Wiprächtiger, Haupt, Heeren, Waser, & Hellweg, 2020). Sustainability combined with design can prepare processes in connection with adequate selection of materials, reutilization of water, decreased energy and optimization of elements associated with industrialization and production, all of which deserve to become differentiating factors for the discipline, and to broaden the epistemic scope of sustainable design (Tsitman & Proshunina, 2019). Without disregarding shared services, rent and repair proposals as alternatives to purchase, sell and waste. Measuring sustainable design's impact on society will be possible when needs and products positively affect the results of project and product exercise, meaning, when the designer interiorizes the concepts of sustainability and offers alternatives from a vision of objects' collective use.

Josep Maria Galip (2014), cited by Niño (2015, p. 106), asserted that the acceptance of programmed obsolescence has very specific "bad

guys": manufacturers and evil engineers and industrial designers who deliberately create products that will become obsolete as soon as the market allows it in order to attract more sales through irrelevant and deceitful innovations (Kinokuni, Ohori, & Tomoda, 2019; Paricio, Peña, & Miralbes, 2019).

Social and cultural dynamics that accompany and modify educational processes in design will strengthen the deficient aspects in which the discipline has incurred, largely because of permanent modifications of form that have failed to create contemporary spaces for design education and an alternative pedagogy that responds to design students' current cultural, social and technological dynamics. In the words of Papanek (1997): "[...] design, the most powerful modeling tool so far, has been used by men to shape himself, to go to its surroundings and move forward" (p. 229). More recent research gives examples of the structure and tasks of a sustainable development design and management system, as well as of its application possibilities as an electronic learning system in the scope of design and sustainable development management (Bolshakov, Shamaeva, & Popov, 2019; Lai & Peng, 2020).

Grasping the universe's extraordinary set of fundamental principles which never contradict themselves and always agree; showing how some of these agreements or adaptations display exponential levels of hunting rarities, which can suppose energetic interactions at geometric levels of the fourth power (Papanek, 1977, p. 10); also helps analyze the economic and social cost-benefit of adaptation strategies of current architectural designs and primary design of barrier-free housing within the context of sustainability, considering the users (Malik & Mikolajczak, 2019).

1

Colombian Desing

Latin American schools are influenced by the Bauhaus, whose teachers and professors, many now Americans, were welcomed in World War Two as means to of scientific, industrial and academic strengthening. In Colombia, Industrial Design was introduced by Jaime Gutierrez Lega and Andres Sicard (disciples of American and Italian academies of applied arts), whose return to the country in the 70's facilitated the creation of design schools in Bogota with the main goal of consolidating the industry and developing an alternative thinking manifesto, which was welcomed at that moment in history. Other studies suggest a framework of sustainable design thinking with five dynamic thinking approaches: thinking with the body, thinking with the mind, thinking with the heart, thinking with the hands and thinking with the soul (Li, Ho, & Yang, 2019).

In the decade of 1930, Bogota was making a huge industrialization effort, but the region of Antioquia was at the top of the country's development as a result of the coffee boom, which influenced progress in terms of the industry's decentralization and succeeding in founding new industrial conglomerates at national level; consequently, this fact also aided the foundation of local industrial design schools (Bolshakov et al.,

2019) such as Universidad Pontificia Bolivariana's (UPB). The principles of economy, order and beauty constituted the baseline for the inspiration of projects such as equipment of municipalities, cities, parks, movie theaters or canteens and more: not only were they in charge of designing new objects, but they achieved diverse functionalities, ease in terms of assembly, incorporating unifying, standardized and interchangeable elements which led to large amounts of applications and combinations, and produced a coherent response to a social context characterized by exiguity and shortfalls.

Ideas of standardization, normalization in element construction for combinations, although in early stages, were more advanced than the time's concepts of these problems, crucial for serial production (Salinas, 1992, p. 115), which make universal design for people an efficient answer to the needs emerging in our society (Malik & Mikolajczak, 2019).

It is worth mentioning that Colombia lacks the industrial infrastructure required to support design. In economic terms, the 70's propelled the coffee industry, which saw a boom between 1970-1979 that caused industrial employment and growth to decrease throughout the following decades. Industries created decades before such as tobacco, footwear, dressmaking and beverages faced an overall downturn; industrial design was worthy of supporting industrial revival processes and added value as core of exports and economic growth, still, its inception in the Colombian context and its application was the result of an academic need, this explains why it's still a hazy road for the industry and the governments, who are largely unaware of the discipline's influence in a country's growth and development, including aspects related to innovation and research (Teng & Qu, 2018; Yi-Fei, 2017).

The 90's were key for the Colombian industry. Workforce productivity was similar as that of the United States, making it the perfect moment to tap on creation of companies and strengthening the discipline's incursion in the market. Up to that moment, Colombia lagged forty years behind in terms of industrial implementation, in addition to the country's civil wars and other forms of violence which resulted in lives and resources lost instead of being used for industrial modernization and development.

Mexico and Argentina's design policies have supported economic growth processes. In Colombia, design's omnipotent momentum has individualized the players and subtracted meaning from common needs; design is still conceived for visualization and contemplation, devoid of significance in public spaces and collective projects for social development (de Freitas, Chamy, & Dumith, 2017).

A specific branch needs to be included in the National Development Plan aimed at protecting, fostering and developing the creation and trade of products, since the legislation lacks dissemination and clarity in terms of intellectual or industrial property, capacities for authors or certainty that protection measures actually preserve the rights and interests of design innovation creators (Zarate, Aguilar, & Dupont, 2008, p. 143).

Compiling heroic stories of designers who founded design departments is ongoing. While designer entrepreneurs continue making

magic in small businesses or microenterprises, manufacturing in minimum scale with obsolete or rudimentary technology, they will continue to be the overlooked titans of design. It is interesting to see how design in Colombia emerges from economic and historic factors as a need of social classes to be differentiated from the common denizen.

In countries such as Finland, United States, Germany, Austria, Japan and Switzerland, design is regarded as a distinguishing factor to support SMEs, development, the economy, people, societies and cultures. In Mexico, articulated actions among sectors such as traditional craftsmanship, government, services and high technology, are in place, the law has granted design a differentiating factor that provides prosperity to nations. Anyway, the topic's real importance is far from being understood in the Latin American vicinity. "In the race for economic progress, it seems as social and cultural activities, ecological impact and long-term effects could be disregarded" (Papanek, 1977, p. 33).

In terms of traditional design education, the contribution of the academia regarding curriculums and study plans regulates educational conditions and critical spaces of the universe being studied, including the goal of high-quality accreditation and self-evaluation and regulation of higher education institutions. Governed by the needs of the field which provoke critical divergences from industrial design's initial and prospective conditions, Latin American universities, with fifty-three design programs as of 1992, adopt stances that aspire the advancement of industrial designers in countries with low, ambiguous and impermanent industrialization, with needs coming from politics more than from industry, a fact that constantly hinders that interconnection, which makes it difficult to acknowledge design in working and professional spaces, leading to a marginalization of the discipline at times. As with other related disciplines, professionals find job opportunities in academia, imposing different challenges depending on the clarity of professional profiles, setting the pace of institutions, engaging curriculum topics as the hidden, influencing, permanent and silent ethos.

We have become infected by the frailty of a present day that demands steady foundations where there are none [...]. While we contemplate the changes, we find ourselves to be constantly torn between desire and fear, anticipation and uncertainty

(Bauman, 2013, p. 28).

Despite the efforts to implement more sustainable and real aspects, design schools are on the edge of a formal incorporation of sustainability. Economic interests linked to productivity remove environmental topics from designers' differential training due to the lack of an appropriate area to perform (Cui, Fang, & Zhou, 2018; Trevino Sherk & Cobreros Rodriguez, 2019).

From Academies and for Designers

Historically and socially, the market engages design professionals in working spaces of software operation, illustration or advertising.

Designers dignify those spaces despite a lack of clarity in their functions and in the understanding of their comprehensive potentiality in fields such as innovation, sustainability or biomaterials; their job comes down to the reproduction of ephemeral elements of contemplation, without value and social contribution, which with the right amount of development, could be reinforced to cause economies of scale to grow.

Following their training, designers recognize their skills and further them with technical education or specializations, followed by constant analyses of the job market and the field, which allows them to interiorize expectations that focus on the operational aspect, leaving projects, research, inquiries and change aside.

The search for an overall thinking and discipline consensus is full of thorns, it affects design's sustainability and design for sustainability. Environmental efforts are still minimal. It is common for many designers not to interiorize at least product's life-cycle assessments to accompany current and future training processes (Khan et al., 2017). A shift towards more effective realities and roads of design is necessary. The aforementioned does not arise from personal empathy with the matter, but from the personal and professional need to become involved in areas with more affinity and larger projection. "The frame in which current design must drive needs to be more social than productive, more decisive than creative and speculative, more idealistic than staged" (Viñolas, 2005, p. 201). Considering the discipline's lack of unionization and its tendency towards divergent thinking, built by each school, academic spaces become areas of contradicting hues. Formal literature about Colombian design is vague, and although the exercise of researchers is permanent, academic pressure for results thwarts the verification and construction of quality documents to solidify autonomous, critical and unifying design thinking. Design teachers' training has involves diverse areas with or without discipline affinity, and permanently focuses on deficiencies in undergraduate level, such as administration and marketing, which offer more competitive job opportunities; moreover, teachers disconnect themselves from common jobs for design professionals -where activities are substantially distant from classrooms-, thus, obstructing working and personal connections to access the professional market.

Monetization of the academia permanently hinders actual or critical thinking. Teachers' work overload in diverse institutions makes it difficult to pursue intellectual, professional and personal growth, which in turn translates to the students, who perceive burnout as a lack of interest by teachers in Colombia. Permanent job turnover, non-competitive hiring and the divide between academia and the real or industrial world destabilizes opportunities to build joint knowledge in current and accurate performances, including sustainability. There are merely operational jobs, oftentimes poorly paid, due to a lack of knowledge in terms of what to do in the field and to lack of reinforcement strengthening new knowledge in design. As a result, academic and ethical liabilities must be assumed in connection with students' training and their duty as social players. Guidelines such as interdisciplinarity, solidifying teamwork,

global communities and personal skills can contribute in curricular renovation to train a new generation of designers.

University	City
Universidad del Norte	Barranquilla
Politecnico Gran Colombiano	Bogota
Universidad Antonio Nariño	Bogota
Universidad Autonoma de Colombia	Bogota
Universidad de los Andes	Bogota
Universidad del Bosque	Bogota
Universidad Javeriana	Bogota
Universidad Jorge Tadeo Lozano	Bogota
Universidad Sergio Arboleda	Bogota
Universidad Nacional	Bogota
UDI	Bucaramanga
Universidad Industrial de Santander	Bucaramanga
ICESI	Cali
Instituto Departamental de Bellas Artes	Cali
Universidad Antonio Nariño	Cali
Universidad del Valle	Cali
Institucion Bellas Artes Bolivar	Cartagena
Universidad de Ibague	Ibague
Universidad Autonoma de Manizales	Manizales
Instituto tecnológico Metropolitano	Medellin
Universidad Bolivariana	Medellin
Universidad EAFIT	Medellin
Universidad de San Buenaventura	Medellin
Universidad Nacional Palmira	Palmira
Universidad de Pamplona	Pamplona
Universidad de Nariño	Pasto
Universidad Catolica de Pereira	Pereira
UPTC	Tunja

Table 1.
List of universities with a Design program in Colombia
Source: Galan (2017)

Current generations of students do not adhere to what is traditional, teachers must understand this, and departments and institutions' policies must be serious about it. Educating for the 21st century is a challenge to tackle immediately; flexibility in content and spaces must make room for exclusion or inclusion of components that redirect knowledge towards specific development of personal and context competences and skills (França, Broman, Robert, Basile, & Trygg, 2017).

"The study plan ought to be an elastic net with activities and techniques that demand creative problem-solving. There cannot be a division between work and free-time activities" (Papanek, 1977, p. 325).

Consequently, the discipline lacks systemic strength to back support processes from design to economy, its initial purpose. Design curriculums offered by some institutions fail to have administrative tools or tools that focus the student towards specialization (Perpignan, Robin, & Girard, 2017).

2

Findings for Designers

In terms of discipline, there are coincidences at national and international level, with strong differences in the Colombian context's thinking. Some curricular suggestions are inclined to higher flexibilization of subjects and aim at working in what the students want (from the training process). Straitjackets in education are dying spaces in pedagogy.

It is important to recognize the effort of Colombian academia to include some areas pertaining sustainable design in its study plans, program's educational projects or occupational profiles; still, there is no cross-cutting axis associated to the specificity of sustainable design to underpin global efforts. Contradictorily, global citizen training is motivated from the training space.

Therefore, design must understand that today's students are unlike yesterday's, and will not be like tomorrow's, "as it used to be". Information travels faster than we can keep up with, and education must shift until it finds that limit space where deeper knowledge is generated. "If we intend to attain said knowledge, we will have to evaluate based on sociology".

Available knowledge duplicates every seven years, and by 2030 it will be duplicated every seventy-two days; therefore, being updated, learning, becoming and being employable will all increase at the same rate. The same thing will happen with time allocated to care and entertainment. However, the time to sleep or love will remain unaffected (Atalli, 2006, p. 138).

Schools do not seem to be interested in deconstructing design, unlearning requires an energy that might be best focused on attracting students, enrolling them for five years in the academia and, luckily, recognizing skills that were unattained in education in different settings. Study plans appear to be projected based on the rubble of reconstructions, "there are subjects and topics that cannot be attached even with glue". Hence, the academia must be liable for the following:

1. Understanding others and itself from the national and/or global context.
   Recognizing its students and the reasons why they are there.
   Looking for joint creation spaces for knowledge.
   Unifying the discipline's topics that allow professional recognition and set epistemological foundations of Colombian industrial design in the future.
   Having a sustainable and innovative wager on spaces apart from qualified records or high-quality acknowledgement.
   Generating and communicating clear guidelines for teachers and students in terms of what they are going to teach, learn and be evaluated on
   Making joint efforts to find education's social responsibility, which should be a mandatory factor of development and education.
   Understanding ideological diversity but building on each academic community member's expertise, providing an answer

to the question: How can design contribute to sustainable development in Colombia?

3

Education for the Future

Education developed in the 18th and 19th centuries was of public nature, and conditions made it difficult for massification and transition with real and unbiased standards, leaving aside an understanding of people's capacities, at times not so different from today's educational quality in some contexts. Training citizens on specific knowledge divided people in two factions: economic or intellectual. Sir Ken Robinson formulated these conditions in books, videos and text, he proposed a change in paradigms and a fracture of schemes. Current design and education must be DISRUPTIVE. This is where opportunity is disguised as difficulty.

Evidently, humans are different and diverse, and transculturation has permanently contributed to educational systems and methods. Universities and its players constantly face change, in the words of Gonzalez (2008):

In knowledge societies, we will have to learn how to cope at ease in the midst of a crushing avalanche of information, and also to develop a critical sprit and enough cognitive capacities to differentiate useful information from that which is not useful. (p. 3)

In the future education report, Becker (2017) addresses topics that will generate impact in education, as follows. It is key for designers and teachers to understand that the era of knowledge and information moves at a different, swift speed, which forces players to update future dynamics of interest in collegiate bodies, businesspeople, alumni and students.

This is the consolidated list of current challenges for training future professionals:

Long-term:

Promoting innovation culture: creativity and design as a source of innovative solutions for the context's social problems.

Deep learning: "Knowing how to" the described formula is: critical thinking + problem solving + collaboration + personalized learning = educational alchemy.

Mid-term: (two or three years ahead)

Focusing more on learning metrics: learning analysis techniques and data mining that record students' interaction with digital settings, progress and status, detecting problems and root causes.

Redesigning learning spaces: advance in multimedia and wireless technology, using it to create more "intelligent" and encouraging spaces which allow interactive, collaborative and motivating learning.

Short-term (in one year)

Mixed learning designs: this trend is recurrent in each learning stage. The mix between traditional settings and new digital settings (be it in mobile devices, live or in the cloud) appears to have been adopted by all of the educational universe.

Collaborative learning: collaborating to teach/learn, following the four principles proposed by the report: student-centered, communication and interaction-boosting, group work, and solution-solving or design based on real situations and challenges.

Less than a year from today:

Less than a year from today:

§ Adaptative learning technologies: those that will adapt to the student's interaction, progress, and that will offer the content he/she needs to guarantee constant progress.

§ Mobile learning: [...] teaching and learning have become portable. The place and device are no longer an excuse to access educational applications of any sort (Icfpeuskadi, 2017, par. 15).

In two or three years the Internet of Things, augmented reality, management systems focused on content administration and personalization will be nearer, which is why artificial intelligence and the use of more intuitive interfaces are future challenges for designers and academia.

Implementing cooperative education will enable students to understand their specific needs that can be applied in a real setting, which technological and social changes incite them to comprehend how to think the world and which applied knowledge must current professionals have to adapt to the environment and dignify their life and profession. New competences include values, social and sustainable design, obviously facilitated by new technologies. It is possible to establish new competences that allow discipline and working significance, as follows:

1. Development of technologies that drive sociocultural change.
   Environmental capacity to produce sustainable design.
   Construction of projects that drive social innovation and economic development.
   Control over life-cycle assessments to evolve into a more sustainable society.
   Influencing a product's aesthetics and sign to induce more intelligent and responsible consumption.
   Training to allow the replication of knowledge in sustainable development.

It is convenient for designers to shift traditional product design training, it should broaden applications and knowledge into more human interdisciplinary jobs that exceed the performance limits proposed by the 20th century. Zachary Jean Paradis revealed to Bruce Nussbaum, author

of Creative Intelligence, some concepts that might orient the structure of new design:

1. Design's largest problem is flexibility.
   It is as if it selected its clothes depending on the topic.
   Every design method has been taken from other disciplines.
   Design has turned into what people need.
   The disciplines' specialization is necessary.
   Sustainability is not the sole responsibility of one discipline, but of every discipline.

Education for Sustainable Development (ESD)

UNESCO's 2015 vision is clear: education for all and Education for Sustainable Development -ESD. It brings together holistic, transformation and inclusion aspects. It is important to clarify that many of the decisive factors in UNESCO's project and in the project resulting from this thesis are based on the idea that education must be a global project, and a project that is accompanied by diverse players in the process, i.e., governments, associations, teachers and students. In that context, universality plays a critical role in the next decade's education agenda. "Incorporating sustainability practices in the contexts of education and training (with strategies that encompass institutions as a whole)" (Tang, 2014, par. 8).

UNESCO (2014) accepted that the world's literacy goals are unattainable: 774 million people are illiterate, two thirds of which are women. These people will lack access to higher education and will be excluded by the socioeconomic system; moreover, people's needs for gender equality and equity are acknowledged, as well as other competences that will enable them to enter new economies and societies to improve their and their families' quality of life.

Education is the road to eradicate poverty and inequality, it is a right of every human being in the planet, a principle of sustainability. Improvements in education must come with global indicators that allow evaluating statuses and deficiencies of education, as well as quantifying development to make it truly global and cover as many people as possible. Challenges set in 2015 and attainable by 2030 must follow these overall guidelines:

1. Inclusion of gender equality.
   Free and mandatory literacy and primary education for children.
   Higher GDP investment in education.
   Training in global and citizens of the world competences.
   Teacher training on sustainability and global presence competences.
   Appropriate work as a right to a dignified life.
   Quality education for all.

It is important to work on two components that substantiate the design education project: teacher skills and training. These are already part of world policies to be implemented, which is why Colombia -as a developing economy- has to be empowered by the challenge in order to achieve joint growth that leads to social and economic strengthening.

Committed educational institutions will contribute to the construction of basic competences around these human disciplines:

· Mathematics to help students understand extremely small numbers.
· The art of language, especially in terms of media literacy.
· History teaches the concept of global change while helping students to acknowledge the change that has been ongoing for centuries.
· Reading develops the ability to discern between fact and opinion, thus helping students become critical readers.
· Social studies help students understand ethnocentrism, racism and gender inequity, as well as recognize their expression in communities and nations throughout the world.

Sustainable development education looks for the students' constant participation in class activities, fostering higher order thinking skills; it understands local environments and has the capacity to adapt to each culture. As ESD suggests, this model includes strength-based work, which contemplates factors such as interdisciplinarity and identification of problems related to sustainability.

Consequently, making sustainable design cross-cutting by achieving integration of all academic activities including curriculum, content, models, experience and evaluation, is part of the comprehensive training that design students should receive. Cross-cutting axes become generalized instruments that permeate the entire educational structure and are intertwined with the areas of knowledge and coexistence. These cross-cutting axes are inter and transdisciplinary, bring down knowledge absolutism exercised by some professors and are complementary through classroom support activities with real simulations.

The incorporation of areas such as ecodesign, management and prospective are essential for the academia; likewise, it will benefit current production and consumption models that are indispensable for the implementation of sustainable design. "Green Consumers" must be serviced, industries will demand these characteristics to fulfill sales goals, compete and endure in the market under sustainable economic conditions.

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