Doctoral Dissertation

COLOUR DESIGN TRAINING ITINERARY

A Framework for the Teaching and Learning of Colour in the Design Discipline

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ABSTRACT

Colour is an essential element in visual perception and, at the same time, it is one of the most complex. During the last 30 years, studies about the inclusion of colour in the aesthetic and project-based education (design, architecture, art) had evidenced a lack of consideration of colour at the university level and a great need to provide training resources to teachers and, consequently, to students at higher education level. Designers often graduate without receiving proper training about colour and, hence, almost exclusively relying on intuition, personal taste or self-learned knowledge when they choose colours. However, the invisibility of colour within the design academy is not always reflected in the professional practice of the discipline. In recent years, there has been a growing tendency to consider practices related to the application of colour in design as a new sub-discipline. Following the requirements of industry, some designers have begun to specialise in this field of work and have started to call themselves 'colour designers'. This emerging figure is still incipient and its field of action within the discipline of design is not yet widely recognised, and as a consequence, it has not yet been sufficiently institutionalised within schools or professional training institutions.

With all of the above, the main purpose of this research was to evaluate the key elements that should be considered in a colour literacy for current design education needs within higher institutions, and to propose an educational framework that may support the teaching and learning of colour in the design discipline. In the search of a guiding thread for the didactic innovation developed, the research relies in the pedagogical model called *Constructive Alignment* developed by J. Biggs, which represents a convergence between a constructivist understanding of the nature of learning and an aligned design for outcomes-based teaching. The research sought to provide design and colour teachers with clear guidelines to specify learning outcomes, teaching and learning activities, a comprehensive knowledge framework and assessment criteria to provide feedback to students. The main output of the research is the *Colour Design Training Itinerary* (CDTI), a complete educational framework that defines different levels of action for the improvement of the teaching and learning of colour in the design discipline. The CDTI framework was built through consultation, involvement and collaboration with colour teachers from different countries and backgrounds. Also, the CDTI is intended to be useful for different pedagogical contexts, in relation to how teaching and learning is changing and adapting to the current international scenario, in other words, considering resources for in presence teaching, blended-learning and online-autonomous learning.

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1. INTRODUCTION: A PROGRAMMED IGNORANCE OF COLOUR

"Rescuing colour from the restriction and atomic isolation to which it had been condemned, to recover it for the dynamic current of life and action"
– Johannes Wolfgang von Goethe.

Colour is an essential element of design, and, at the same time, it is one of the most complex. The knowledge of colour comes from a multiplicity of disciplines: e.g. from physics, in its immaterial interplay with light and space; from chemistry, concerning the material substance of colourants and pigments; from psychology, when conceived as a symbolic language and capable of producing different effects and affects in the human being; from arts and aesthetics, when considered an aspect of beauty, harmony and visual pleasure; among many others. Many disciplines related to colour have historically sought to structure the knowledge on this subject, resulting in an enormous number of treatises, theories, concepts and terminologies, which together make up a vast, complex and often disorganised epistemological body. This field of knowledge has been called for centuries with the reductive name of '*colour theory*', when in fact it consists of much more than only theoretical postulates: so much of what we know about colour today is due to the practical and applied work of artists, colourists, architects and designers, and corresponds in reality to fundamental empirical knowledge without which would be impossible to understand the chromatic phenomenon completely. In the light of this, more and more colour researchers are becoming aware of the need to consider the study of colour as a discipline in its own right and have proposed to call it '*colour science*', where science can be understood as '*knowledge arranged in an orderly manner, especially knowledge obtained by observation and testing of facts*'. From this perspective, the word *science*, far from removing colour from a creative perspective or from putting it in the opposite pole to the arts, aims to integrate all disciplines that study it: the scientific areas related to its vision and perception; the aesthetic fields in which it is used creatively for its selection, combination and communication, the commercial aspects of the products and productive sectors in which it is applied, and the technical considerations for its reproduction as well as the regulations and tools that allow it to be managed and codified, just to name a few.

Away from the more complex aspects of colour science, the visual experience of colour is omnipresent in our daily lives. Everything we see around us is coloured, as are all the objects we use, including our bodies, hair, and skin. Many of our decisions every day are based on colour choices, which are often unconscious: from crossing a street guided by the traffic lights to the final step to buy a product once we have explored its features. Colour is so present in people's lives that it is often taken for granted. We notice colour only when we see something that catches our attention, that generates visual pleasure or dissonance in the natural or human-made environment surrounding us, or when an object or product becomes iconic through an original, usually intense, chromatic palette. However, despite the impossibility of conceiving a colourless world, the discussion about colour has been historically minimised within the aesthetic disciplines to only

some relevant treatises. On numerous occasions, the reflection on design and design thinking, criticism, and disciplinary research has avoided naming colour as a fundamental element in planning the built world. Furthermore, there is an even greater silence in the subject of colour teaching in design, architecture and art, despite the relevance of visual skills in the roam of these disciplines.

During the last 30 years, studies about the inclusion of colour in aesthetic and project-based education have evidenced a critical panorama: there is a lack of proper training of this subject at all educational levels –primary, secondary and higher education–. Additionally, scholars have highlighted a great need to provide colour training resources to teachers and, consequently, learning tools to students. For instance, in primary and secondary school, the inclusion of colour encompasses only some passages of the artistic subjects. Studies conducted in Western countries have shown that children receive obsolete content, both in terminology and teaching methodologies. After the first years of children's education, colour generally disappears from artistic teaching as a specific topic. Usually, teachers lack tools and courses to train themselves and adequately explain colour to their students. Besides, usually, art teachers had a formal education in this field due to the diffuse unfortunate reality of artistic education in primary and secondary schools (Howard 1989). Hence, most teachers come from backgrounds that are not directly related to colour, being trained in disciplines such as literature, history, religion, and English, among others. Furthermore, the high cost of refresher courses and didactic material is unaffordable for local and state schools.

The issue of colour education in design

In the context of higher education, **the lack of regard for colour** has been recognized as current international malpractice in design, architecture and art schools. Studies revealed that less than 40% of design schools include colour education in their study programs (Bantom 2006; Minah 2008). Within those schools, colour is sometimes offered as an elective course or as short courses in the form of continuing education (with a duration of one semester or less), the choice of which is left to the students' discretion. Other times, the subject of colour is taught even less, in a few lessons inside another course, usually basic design courses. However, technical or advanced colour knowledge is rarely meaningfully integrated. In both cases, the dedication of hours to colour training is insufficient. The issue becomes critical when we consider that those colour lessons are probably the only instances that students will have to learn colour within their degree. Evidently, the remaining 60% of schools leave colour straight out of their curricular planning.

Going back to the design schools that do teach colour, apart from the low dedication of teaching hours to the subject, there is usually another relevant problem: **courses are mainly focused only on colour theory, without considering colour application in design fields.** In many cases, the lectures and assignments do not go beyond theoretical knowledge, such as the colour wheel, harmony, and colour systems. Additionally, this knowledge of colour theory, undoubtedly essential, in many cases, **has not been brought up to date with the current needs of the design discipline.** Getting acquainted with colour theory is only a mere starting point for colour education. Design educators, therefore, should teach more about the use of colour in practice, in design, commerce and industry. T**he lack of proper colour education results in poor confidence** in design students

and professionals regarding skills to make colour decisions in design projects. Indeed, when having no confidence in their colour selection skills, design practitioners circumvent colour decisions that are often designated to others who are more expert or even junior designers. Additionally, scholars have shown that if students do not receive motivation or awareness-raising on colour's value during their design formation, they are **unlikely to seek further colour training** afterwards. They will probably not explore colour as practising designers. The latter will continue to contribute to the vicious circle of disregard for colour in design.

Transversally, two main motivations for the low consideration of colour education have been identified: the first refers to the complex interdisciplinary nature of colour knowledge, addressed before. The wide-ranging nature of the phenomenon of colour seems to complicate its complete understanding and the delimitation of a body of study centred on the creative disciplines. This interdisciplinarity can produce communication problems between the different fields that use colour (sciences, arts, design, philosophy, chemistry, among others) as each of them may have their own professional language. This issue can give rise to different challenges for designers, teachers and students at various levels of complexity: from difficulties in comprehending basic terms to refer to the phenomenon to problems concerning the understanding and appreciation of the role of colour as a significant element of the discipline of design. The second motivation relates to the debate on '*colour and form*', where the form is considered a fundamental element of design, which gives *shape* to things, and colour is seen as a mere aesthetical characteristic of form, hence, a secondary element of design. This low status associated with colour in design and design education can be explained by a tradition inherited from a mixture of historical '*chromophobia*' (i.e. the prejudice or fear of colour, Batchelor 2000) and the teaching of architecture, a discipline with a much more formalistic practice from whose Faculties or Schools and design-studio based pedagogy, the teaching of design discipline was born. Within this motivation, colour is wrongly considered linked only to the designer's personal taste and individual expression.

Some colour theorists have defined this lack of consideration of colour in design programs as '*the contemporary bias against colour*' (Willard 1998), '*the marginalisation or exclusion of colour from higher education*' (O'Connor 2010) or, more recently, '*a programmed ignorance of colour*' (interview with Anna Marotta in 2019). All these definitions refer to the invisibility or inattention of the design academy towards colour, which reveals that it is often little considered compared to other resources related to visual perception. Just to name a few, shape, drawing and perspective are often thought in depth, confirming that visual education is fundamental and, at the same time, supporting the thesis that colour is unequally treated. In this scenario, colour is usually considered a cosmetic element instead of a powerful feature for design, which defines messages, meanings, product's interfaces, functions, or consumer's behaviour, among others. Designers often graduate without receiving proper training about colour and, hence, almost exclusively relying on intuition or self-learned knowledge when choosing colours, espousing the idea that successful colour applications in design depend on the designer's natural gifts and experience.

However, the invisibility of colour within the design academy is not always reflected in the professional practice of the discipline, nor even within the research community. In recent years, there has been a growing tendency to consider practices related to the application of colour in design, encompassed under '*colour design*', **as an emerging subfield of the discipline.** Following industry requirements, some designers have begun to specialise in this field of work and have started to call themselves '*colour designers*'. This rising figure is still incipient, and its field of action within the discipline of design is not yet widely defined or recognised, and as a consequence, it has not yet been sufficiently institutionalised within schools or professional training institutions, resulting in a lack of educational instances to train *colour designers*. On the other hand, during the last 20 years of colour discussion within the research community of reference, the *International Colour Association* (AIC), the use of the term *colour design* has constantly been growing. It nowadays is widely applied to identify the specific research work of designers working with colour in different areas, from environmental colour design to fashion. Again, even if scholars are often also teachers within design institutions, it appears that the practice of colour design has still not permeated institutional barriers and has not received greater attention in the educational praxis of the discipline.

In fact, the colour research community has been for years highlighting this problem in education implementing different dissemination strategies to provide more attention to the issue. From 2019, the two important colour associations in the world, the Inter-Society colour Council (ISCC) and the AIC, indicated **the lack of defined guidelines for colour education** as the highest priority to take over by researchers in the years to come. From then on, the associations are currently cooperating on large-scale research on the state of colour education, called the *AIC-ISCC Colour Literacy Project* (CLP). The CLP has been implemented as a four-year project, which goal is '*the design, production and promotion of an introductory colour education for educators in all disciplines and at all levels*', from kindergarten to PhD. Colour education will be built on the transdisciplinary re-foundation of basic colour concepts and a constructivist approach. As the author of the thesis is a steering committee member of this relevant project, this doctoral research will inform the CLP, and its results and artefacts will seek to contribute to colour design education at an international level.

This doctoral research is the culmination of a consistent investigation carried out by the author during the last thirteen years on the topic of colour education. It began in 2008, during the author's bachelor thesis in Graphic Design, which inquired about valuable resources and methodologies in Spanish to teach colour in graphic design (Calvo Ivanovic 2009). That first investigation resulted in *Proyectacolor*; a website focused on providing aids for the teaching and learning of colour, which was constantly curated and updated. Proyectacolor was online for ten years (2009-2019) and became the most relevant platform on the subject in the Spanish language, receiving more than 1000 daily visits from users from all over Latin America and Spain and being presented in several international dissemination events. During those years, a second study was carried out in the context of a Master of Arts (MA) in Image Studies (Calvo Ivanovic 2015) which addressed the educational nature of Goethe's *Theory of Colour (Zur Farbenlehre*), treatise focused on learning colour through a phenomenological

approach, i.e. from direct observation of the chromatic phenomena. Moreover, the MA research also studied the history of the chromatic circles as primary visual aids to explain and study colour, a geometrical scheme with didactic purposes.

In parallel, since 2008, the author has been involved in different projects concerning the teaching and learning of colour, which addressed (i) the definition of state of the art on colour teaching in the Latin American context; (ii) a study to didactic materials and resources to teach colour at primary school level; (iii) an analysis to the inclusion of colour within the national curriculum of visual arts of the Chilean Education Ministry, at primary and secondary education levels; (iv) the curatorship of a 1-year educational exhibition on colour in a relevant Chilean museum (*Centro Cultural Palacio La Moneda*) and numerous colour training instances for secondary and higher education students; design, architecture and art teachers; and designers and other professionals in different fields, in Chile and Italy. All the experiences mentioned above have provided inputs, data and relevant insights to inform this doctoral research.

1.1. RESEARCH RATIONALE, QUESTIONS AND PURPOSE

The research gap and questions

With all of the above, the research gap has been identified as: 'the lack of proper colour training in design higher education, as the teaching of colour is not aligned with the current design discipline needs'. And, therefore, the research questions (RQ) are:

RQ1: *What are the relevant aspects regarding colour knowledge and decision-making in current design discipline needs that should be addressed through colour education?*

RQ-2a: *How has colour been taught in design education higher institutions during the last decade? RQ-2b: What relevant aspects regarding colour education are missing or can be improved?*

RQ3: *What are the main instructional elements that should be considered in a didactic innovation concerning colour for current design education needs?*

RQ4: *How a colour literacy innovation can be implemented in colour education in higher design institutions according to different contextual needs?*

Main purpose of the research

The main purpose of this research is to evaluate the main elements that should be considered in a colour literacy for current design education needs within higher institutions, and to propose a complete educational framework that sets out different levels of action for the teaching and learning of colour design within design discipline.

In the search of a guiding thread for the instructional design of the educational project, the research relies in the didactic approach called *constructive alignment* developed by J. Biggs, which represents a convergence between a constructivist

understanding of the nature of learning and an aligned planning of teaching activities. According to *constructive alignment*, learners construct meaning from the learning experience which leads to lifelong learning (Biggs & Tang 2007). The teacher proposes a conscious alignment where learning outcomes are the starting point. This is an effort to provide the learner with a clearly specified objective, a well-designed learning activity or activities appropriate to the task, and well-designed assessment criteria to provide feedback to students. The *constructive alignment* was identified in the research's literature review as a constructivist suitable model that provides pedagogical basis for a student-centred innovation in design education, able to easily dialogue with design-based learning (DBL) for different design education needs.

The main contribution of the research will be then the *Colour Design Training Itinerary* (CDTI), a **complete educational project** that sets out different levels of action for the improvement of the teaching and learning of colour in the design discipline. Moreover, the CDTI provides the **basis for curriculum structuration of colour design** as a subfield of design discipline. The core didactic approach implemented on the CDTI was the *constructive alignment* and, accordingly, the CDTI was developed and structured from the *alignment* of the different elements that shape the educational itinerary: (i) the definition of specific training paths for different design education needs; (ii) the proposal of guidelines for defining intended learning outcomes according to both the knowledge dimension and the cognitive process dimension; (iii) the modulation of relevant colour contents for design following the knowledge clusters defined in the new framework; (iv) the description of teaching and learning activities concerning colour from a DBL perspective and their exemplification; (v) the proposal of guidelines for the creation of assessment strategies to evaluate students' learning and (vi) a compendium of colour bibliographic and complementary mixed media materials as a suggestion for design teachers and curriculum planners. The CDTI project has been built through consultation, involvement and collaboration with colour teachers from different countries and backgrounds. Also, the CDTI is intended to be useful for different pedagogical contexts, in relation to how teaching and learning is changing and adapting to the current international scenario, in other words, considering resources for in presence teaching, blended-learning and online-autonomous learning. Finally, To support the CDTI implementation and dissemination for broad contexts and needs, two research artefacts were developed, an *Open Educational Resources Repository* (OER) in the shape of a website, and an *Archive of Teaching and Learning Activities.*

1.1. THESIS OVERVIEW AND STRUCTURE

The research thesis is divided into four parts: Part I – Background Knowledge; Part II – Research Plan & Methodology; Part III – Research Development; and Part IV – Main Findings & Discussion.

Part I – Background Knowledge, starts with chapter 2, **Colour in Design – The Challenges of an Uneasy Resource,** which will introduce the reader to colour, first from contextualisation to the historical issue of the lack of regard of colour within aesthetic disciplines and second, as a field of knowledge in its own right. The relevance of colour for design discipline will follow through identifying the four

phases of colour decision-making for current design discipline needs. After that, looking to study the state of the art of the epistemological basis of colour, nine colour knowledge frameworks proposed by colour experts and teachers will be reviewed by identifying relevant contents for the design practice, knowledge organisation and the definition and recurrence of colour terms used. Then, the research gap, the issue of colour training in design, is presented according to its different actors, design teachers, students and professionals. This issue is addressed by identifying the leading causes, consequences and opportunities to solve it. Subsequently, the concept of *colour design* is described, by providing a novel definition to it, together with the outline of its main characteristics, challenges and the work field of the colour designer —three examples of international colour design curricula complete chapter 2.

Part II – Methodology & Research Plan

Part II, Methodology & Research Plan, is composed of chapter 3, which will present the definition of the research gap and opportunity, together with the research questions, main purpose and specific objectives. After the research approach, four phases and tools implemented are described. At the end of chapter 4, the research overview is visualised.

Part III – Research Development

Part III – Research Development is composed of four chapters. Chapter 4, **An Analysis Of The State Of The Art Of Colour Training In Design Higher Education During The Last Decade,** will introduce a comprehensive analysis of 103 colour courses taught within design programs of higher education institutions from different countries during the last decade (2010-2020) within the Western world. The chapter starts by identifying the aims of the analysis, the sample selection criteria, and the study's limits. Then, the formal aspects of the courses analysed will be described: the course level, duration of the course, the entry profile of students, the specific disciplinary area, the course location, type of institution, and the language of the course. After that, the main didactic strategies of the courses are analysed: the learning outcomes, the contents proposed by the course, the teaching strategies implemented and, the suggested bibliography. Finally, a description of the main findings is provided with some remarks on its discoveries and the recognition of the main critical aspects to face when proposing an innovative framework for colour training.

Chapter 5, **Framing the Knowledge About Colour for Current Design Discipline Needs,** starts by presenting an analysis of relevant colour terminology for design discipline provided by the research reference community, the *International Colour Association* (AIC), through a study of 20 conference proceedings of the AIC annual meetings (2000-2019) and the keywords used on them. The collected data resulted from an integration of the papers' titles, their keywords (when provided by authors) and the thematic sections. The analysis criteria and main findings are explained. Then, from the definition of the proper colour nomenclature and the analyses performed, a proposal of a new framework to organise colour knowledge for the design discipline needs is described, which will constitute the content structure for the *Colour Design Training Itinerary.*

Chapter 6, **The Colour Design Training Itinerary,** will present the structuration of the educational project for colour literacy regarding current design education needs, the CDTI. The different elements of the CDTI are described and exemplified through data visualisation; together, guidelines for their implementation are

provided. First, Training Paths are presented as the entire training experience to plan. Then, instructions for writing intended learning outcomes for colour education concerning design-based learning contexts are outlined. After, the content's structure of the CDTI and its modulation is described through examples provided by different simulations of colour courses for postgrad design education. Subsequently, examples of teaching and learning activities and the strategies to assess them are described. Finally, the inclusion of bibliographic references within the CDTI is introduced, and the list of sources will be found in the thesis appendix.

Chapter 7, **Implementation & Dissemination of the CDTI,** will start by presenting the implementation of different types of training paths conducted in various real teaching contexts in design higher education of Chile and Italy, for in presence, blended and remote online learning. Then, the development of the two main artefacts of the research are presented, the OER Repository website and the *Archive of Teaching and Learning Activities*. Finally, different strategies for academic and social media dissemination are described.

Part IV – Main Findings and Discussion

Finally, in *Part IV – Main Findings and Discussion*, chapter 8 summarises the major discoveries and contributions to knowledge of the doctoral research phases and activities and discusses them in the light of the research questions proposed at the beginning of this study. Then, the research paths opened, and future developments are defined, together with the research limits. Finally, a discussion of some of the most relevant issues raised through the investigation completes the chapter.

Research Annex – Relevant Didactic Perspectives

The Research Annex, Chapter 9, **Relevant Perspectives for a Didactic Innovation Regarding Colour**, will review the noteworthy learning approaches that have guided the instructional design of the CDTI. The chapter starts with *Constructivism* as the educational paradigm in which the CDTI is embedded, providing guidelines for constructivist teaching practices. Then, *Design-Based Learning* is presented as the educational context of the application of the CDTI, and *Basic Design Education*, as the usual place where colour is found within design curricula. After that, instructional design is addressed as a systematic procedure in which educational and training programs are developed and composed aiming at a substantial improvement of learning to describe the different elements that compose an educational project. Then, a revision to different instructional design models will give way to the description of *Constructive Alignment*, the core didactic approach of the CDTI, by explaining the different elements that compose it, namely, intended learning outcomes, teaching and learning activities and the assessment strategies. Subsequently, the revised Bloom's taxonomy developed by Lorin Anderson and David Krathwohl (2001) is addressed as a guiding thread to structure different levels of knowledge inside the CDTI. Finally, different strategies to implement educational technologies in the didactic innovation of colour training are presented to overcome the challenges of current colour remote teaching according to the international scenario raised after 2020.

Research Appendixes

Finally, the Research Appendix, features the Appendix A, with the list of 103 Colour Courses analised in chapter 4; Appendix B, the Colour Exercises Form used for the Open Call for TLA; Appendix C, the Preliminary Colour Knowledge Framework used for the Open Call for TLA, and Appendix D, the List of Suggested Bibliography proposed by the Colour Design Training Itinerary.