

## Teaching Colour: From Canvas to Computer

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### Abstract

*A solid basic knowledge on colour is important in various fields: art, physics, chemistry, biology, and technology. Even psychological aspects of colour perception should be considered when we approach this matter. This paper has the aim to help teachers to present science through an ITC approach that helps students to develop interest in science and to learn. We present a group of activities to achieve these objectives. Taking advantage of the great use of computers in our everyday life and the treatment of colour on computer equipments (colour-light on monitor and colour-ink on printers), a teaching sequence with STS approach has been built up, going from colour addition to colour subtraction, and has been implemented at secondary school level. Using computer applications for comparisons between pictures from drawings software and classical painting on canvas, can lead our student to a better comprehension of the subject.*

### Introduction

At secondary level the introduction of Colour in science classroom shows serious difficulties. Previous knowledge in colour composition from artistic subjects interferes with comprehension of primary light colours. In addition, nowadays, creative works on image are being done either with colour subtraction (pigment, ink) or with colour addition (light).

In this context secondary school students only recognize as primary colours those that have been used in artistic view and ended with null knowledge of physical behaviour of colour. Even though their experience in using paints, pupils do not use primary colours correctly: cyan, magenta and yellow, instead they use blue, red and yellow.

Nowadays not to recognize colour as a property of light and as part of physic studies could led us to parcel our students' knowledge depending on further studies or private interest, and disconnecting science from everyday reality.

### Why focus on colour?

Introducing light colour would be more and more necessary in a technological society that uses computers as quotidian instruments. Even in artistic fields computer have gained over other media. When it refers to colour, how do computer programs work? All drawing applications produce a

very wide range of colours by combining blue, red and green, commonly called primary light colours. Even though other peripheral as printers could translate this information to primary pigment colours, because these are the inks used in them, as one could see be analysing a printer test (Zelenski, and Fisher, 1999)

We believe the study of light and colour and their physical behaviour, including other optical phenomenon, considering only the light transmission and its interaction with objects, is insufficient. Light and colour should be described as a perception where the brain has its important role (Chauvet,1994). Maybe we could say that there is no yellow colour, we could describe the perception of yellow as the result of light with certain wavelength or as the result of the composition of two light beams with wavelength on the red and the green part of spectrum, as well as many other possible combinations.

Colours are present in the everyday life of students and they have been used freely in their productions. Considering this fact and the high interest that computer tools have in our society, we could expect that focusing the study of light and colour on computer work could interest everyone.

### A integrated science approach as a proposal

Our proposal is a sequence of activities including concepts such as light colour and pigment colour, relating them to new technologies, and referring, finally, to colour addition and colour subtraction (Viennot, 1996) The use of computer drawing programs and paints, available to our pupils, gives the teacher the possibility to adapt the proposed activities to educational necessities, allowing the students to work in an autonomous way.

### The activities

The sequence offered in this paper to achieve the fully comprehension of colour addition and colour subtraction, could be divided in seven different stages. Let us present briefly the activities (Melià, i Plana 2003) included in it:

1.- A computer application (colorsRGB) (Plana, 2003) allows to combine primary light colours on computer screen. By proposing exercises to colour a surface until it will be perceived as equal to a predetermined colour on a square en the centre of the working screen (fig 1), students understand

the variability of colours, the wide range of possibilities, and the production of them as combination of primary ones.

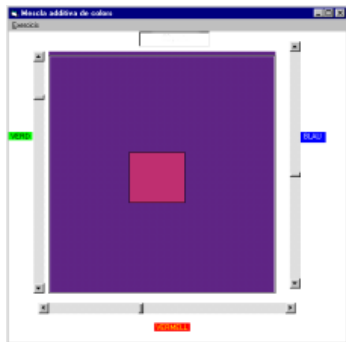


Fig. 1 ColorsRGB application

2.- Students work with a drawing program as “Paint” to analyse the construction of colour on computer screen by using colour addition and primary light colours. They are asked to colour a simple drawing with primary colours and with their complementary ones. Until here, students have been working only with colour addition.

3.- Later, the observation of printing progression with an ink printer approaches the students to the concept of colour subtraction used in this process. Further analysis of printing test or images obtained with a printer cartridge without some of the basic colours complete this activity.

4.- In this moment we switch to the use of paint, trying to reproduce the same drawing proposed at stage 2 by using red, blue and green tempera with similar computer tonalities. Students are asked to reproduce the same combinations used when adding light in computer. Students can easily conclude that there has to be some basic differences between paint and light and that binary mixtures of red, blue and green paint. Now, the colour subtraction produces brownish colours.

5.- To reinforce colour subtraction process, a computer program (Llum i Color) (Plana, 2004) (fig. 2) is used. This software allows to simulate processes in which selective absorption of colours take place inserting filters and using a reflective surface painted with different colours. In it, a simulated light beam that can rotate is focused on the painted surface after going through filters. The proposed surface that reflects the light beam to the eye, could also be painted using primary paint colours selected from upper containers. The possibility to analyse the composition during the whole path of the light beam helps the students to interpret the phenomena.

6.- Working again with paints, the image in previous activities has been reproduced by using primary paint colours: cyan, magenta and yellow. Results reinforce the difference between colour addition and colour subtraction.

7.- The final activity asks for analysis of two drawings, one obtained using green, red and blue colours (primary light colours) and the other produced by primary paint

colours, that absorb one by one primary light colours. The comparison of these drawings clarify the difference between light or paint primary colours.

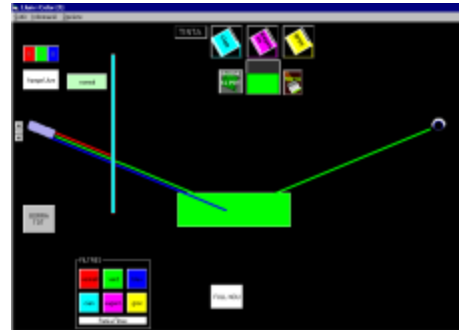


Fig. 2 Llum i color program

## Conclusions

This sequence has been used firstly with two groups of 15-16 years old students (ESO) with low abilities. Feeling colour near to them has been the main motor to interest them in science. Moreover, “hand on” activities like these ones have helped them to achieve our objectives on colour composition understandings.

Further implementation will be done next year together with the proposal to analyse filters and study colour perception.

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