Project Worksheet

The Colour language at Universe

Colour is the place where our brain and the universe meet. Paul Cezanne

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1- Introduction

The Universe of colours suggest us questions, orients find answers to build knowledge. Students living in a universe of colours infer "causality from observation" [1]looking for the cause of something when it happens.

Promote of STEM interest (Science Technology Engineering and Mathematics) is one of EU objectives along the XXI century. The reason: the need to creating an European space oriented towards future work demands. The organization of living beings made of elementary cells is the basis for the diversity of organisms. Cells functions specialization, different cell in the different species, environment survival can explain much of the content of colours' language in the universe.

TAGS. Big Ideas Univers. Colour composition. Colour Filter. Colour emotions. Cones cells vision. Colour acidity. Indicator. Virtual Laboratory. iSE. IBSE.

2- Background

Light floods of colour our life perceptions and the colours' Universe play a key role at history.

We live in a universe of colours. Artists create colours. Colours mobilize emotions. Knowledge create products that permit colour change with temperature, inform us of meteorology and of conservation related to humidity. Colour underlies language learning. The colours of the flowers facilitate the reproduction of plants, colours attract insects . Universe is present with different colours through telescope; each stellar object tells us a story. The eye perceive objects with different colours.

Primary School students (9-12 years old) capture colours of light and do an inquiry. This lesson runs on different scenarios, students become aware of different skills/abilities/talent, develop multiple intelligences, and build their own creative productions related with colour . However curiosity arouses different behavior of the animals in the vision of the colours and the multidisciplinary content justifies this proposal work from 9 to 14 years.

The teaching team of Private Foundation Education Dominiques (Tarragona. Spain) has validated this lesson to Secondary Education (in innovation workshop 2015-2016).

3- **Topics** focused on the following **Big ideas of Science**

- *All material in the Universe is made of very small particles. Light in different wavelengths allows to look a coloured universe.*
- *Causality is inferred from observation of effect inevitably that follows to some action.*
- *Scientific knowledge develops technologies to create products to serve human needs*
- *Organisms are organised on a cellular basis*

[1] Derek Bell, et al. Principles and big ideas of science education. rs © Wynne Harlen 2010

- *Scientific explanations, theories and models are those that best fit the facts known in time.*

4- The question

- **I wonder why does life, Earth and Universe looks like in colours.**

5- Concepts

- Universe looks like in colours. (Geology)
- Colour heritage of culture and emotions. (Traditions. Literature. Arts)
- Visible part of the rem. Colours composition. The colour wheel. Filters. (Physics)
- Colours reveal temperature, chemical composition. Acids and bases. (Chemistry)
- The behaviour of animal species and the relationship with the plant environment. Colour construction arises from human biology (Biology)
- Proportions (Maths)
- Industry colours and smart materials (Technology)

6- Methodology of use

We make in value two subjects: a) Inquiry Learning, b) Working Scenarios

a) Inquiry Learning has focussed the work along of Big Ideas (see Topics)

Previously the question (see). This orientation phase builds on images and documents[2]. Students, cooperatively, grow up questions working the *scenario* that are recorded [3] .

Orienting & Asking Questions	Conceptualization Hypothesis Generation	Planning & Investigation	Analysis & Conclusion	Discusion & Evaluation

b) Approach to the language of colours in different disciplines by building learning in different settings and with specific activities focused on the special needs. Learning is built on three scenarios **(s):**

s1) spark interest and encourage building concepts[4] and hypotheses

s2) design and conduct research with a iSE Resource[5] Virtual Laboratory , and bring the language of colours to everyday life with a complementary proposal of context acid base

s3) represent models that help to explain and to discuss the results opening new concerns related to the technology of colour. Search and propose applications laboratories[6]

The backdrop of the construction of knowledge is duplicated:

- A **Worksheet** enclosed in paper accessible from the ODS platform (Resource *The Colour Language at Universe)*. Working Fishbowling (group timing 20 th min.).

7- Target

- To confirm the presence and importance of colours in our daily life on Earth (art, health &colour, science, technology).
- Develop STEAM interest working at responding to the needs of the twenty-first century Europe.

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[2] . https://drive.google.com/file/d/0B5M3LvGbC8SnajZBZWIzT3RmUFk/view?usp=sharing

[3] Video Workshett https://youtu.be/5QYkVYWlmuY.

[4] https://drive.google.com/file/d/0B5M3LvGbC8SnQk90WXpUNzNQMjA/view?usp=sharing

[5] ODS Resource Color Vision http://portal.opendiscoveryspace.eu/content/color-vision-832804

[6] Laboratory of colors. International encoding . http://www.coloreso.es/bolas.swf

- Enhancing the creativity to promote the multiple intelligences and use scenarios approximate research and highlight the diversity of students[7]
- Plan and conduct research using resources iSE [ref 5].
- Establishing relationship Companies-School working colour Science and Technology[8]
- Create misconception alert at eyes function, filter activity, primary colours, daily colours.

8- Participants

Students of Ernest Lluch Library at Vilassar (Barcelona. Spain). 9-12 years old.

Teachers . Teaching staff of secondary assessed, validated and incorporated improvements at "The colours language at Universe". Formation of Innovation Center (2015-2016 ("*Developing multiple intelligences in the classroom"*).Secundary School Dominiques Fundation (Tarragona . Spain).

9. Results

9.1 Children from nine to 12 years of age distinguish between psychological causality (for example, feeling of red colour provides emotional response) and physical causality (for example prepare a colour equal to red cabbage and express the proportions of the RGB components, experience reactions with substances of daily live). Modelling work after simulation enhances understanding concepts, also helps to identifying and reducing misconceptions

9.2 Teachers. Adaptation of the scenarios *("The colours language at Universe")* to Dominiques College of Tarragona. Review and adaptation of special needs activities for Dominiques College students. Students in higher grades could do a more extensive work (Colour encoding. Complementary colours. Colour chemistry (indicator acidity) colour quality of quarks).

10. Discussions of the results

As hypothesis suggests the main factors variation determines construction and vision of different colours.

Simulation was successful. Simulation aroused on smart materials interest, cones work different in different animal species, importance of encode universal. Approach to ghost particles at universe

Misconception alert

- The eye produces no light of its own[9] . Eyes store information objects inverted
- Wave length yellow[10]
- TV monitor functioning
- Filters (Ffilters in photography allows colour but an ultraviolet filter blocks—or filters out—ultraviolet light.)

11. ASSESSMENT [11]

- **Cognitive domain**

REMEMBER. Identify colours contents at different topics. Label, list , select on a Interactive link . Hypertext

UNDERSTAND. Cooperative learning working vocabulary. Define and describe and completing PassWord. Internet search to complet it. . Generalize. Give an example. Infer, predict hypothesis

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7 http://hetah.net. Online software facilitates simple proposals of Braille and sign; singular phrases will label with 3D printer

8 Cromas Company srl.(Via Milano, 21. 20020 LAINATE (MI) – Italy) collaborates with schools sending free thermosensitive samples

9 Many students think eye is somehow a source of light, and that this light helps us see. The eye and brain can create the *sensation* of light.

10 Stimulates two colour-sensing cones' cells : red and green (primary colours).

11 Cognitive domain and affective domain https://drive.google.com/file/d/0B5M3LvGbC8SnS3BHOTZCM25pTEE/view?usp=sharing

APPLYING. Get use to Virtual Lab. Design and conduct an experiment. Manipulate: virtual and real . Modifie variables. Predict

ANALIZING. Recognice changes. Gather data. Compare data. Contrast with mates. Discriminate errors. identify similar results . analyze from the role of observer and enforcer (Fishbowling)

DISCUSSE. EVALUATING. Contrast results. Rubric lesson. Defend conclusions. Describe . Justify. Summarize

CREATING. Create scene for the Scientist Opera Rewrite. Tell

- **Affective domain**

RECEIVING PHENOMENA Listen the explanation of selected image, the results

RESPONDS PHENOMENA Gives a presentation. Questions new i concepts, Comment models

VALUING. Values the diversity of the student group. Hability solving problems and plan improve group

ORGANIZATION. Proposes plan and roles. Incorporates all skills. Prioritizes time effectively

INTERNALIZE VALUES. Revises judgments and changes behavior. Cooperates in group. Affective Objective: To promote interdisciplinary collaboration through multidisciplinary images. Valuing the diversity of students in the context of the diversity of colors, with specific activities, and to mobilize positive emotions about peers with different abilities and talents

- **Phsychomotor domain.** To perform independently, skillfully and precisely . Activities that sequence this proposal developed and psychomotor power needs in its design stage. Moving between scenes, couples and group activities, interactivity in the computer room, real and virtual laboratory, modeling of color vision, proposal Opera, exchange of material between some
- **Students.** Excellent

The incorporation of short and specific activities of attention to diversity has made its way to perform in the future, in new settings content

- **Teachers** Analyze this lesson in workshop (Team teachers Dominique Secondary School. Tarragona .Spain) strengthens the analysis

An anecdote related to actual experimentation. Finished experimenting several students asked to mix the different colours obtained. I will not let him. My thought is that I should have allowed that develops creativity (distort the previously established without prejudice). Secundary students will work it.

- **Use of resources**

ODS Resource Color Vision http://portal.opendiscoveryspace.eu/content/color-vision-832804
Students produce colors: red cabbage indicator color, color selected from the initial images.
Surprise in the operation of the filters and the appearance of related missconceptio UV filter
Rework with Color Vision Laboratory to build the colors obtained from

Laboratory of colors. International encoding . http://www.coloreso.es/bolas.swf
It facilitates highlight the existence of universal coding

Special needs http://hetah.net.
Online software facilitates simple proposals of Braille

The tool has a limited construction sign language vocabulary. However interesting is the possibility to bring this language to all students; also adapting a text to a phrase that expresses the content

The Braille coding is very good and allows to produce labels with 3D printer. It was a proposal, although we have not executed

