

Research, Reflections and Innovations in Integrating ICT in Education

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VOL. 1 (pp. 3-677) · Table of Contents

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General Aspects and Assessment in ICT Education

An experience to define the enterprising attitude as a transversal competence in the European Higher Education Area

R. D. Márquez Ruíz, R. A. Moreno Castillo, C. González Escalante, R. Espejo Mohedano, and E. Herruzo Gómez

Between access and use: a case-study on technology mediation in a school environment

M. Cristina Ponte, Ana M. Jorge, and Daniel S. Cardoso

Breaking the digital divide and social integration.

Okike Benjamin

CaCoCu: a multimedia channel to disseminate the contemporary culture as a source of educational materials

J. L. Bernier, S.G. Mendoza, M. Barchén, and I. Rojas

Communication Channels of a b-learning experience in Higher Education

D. Rodríguez García, M. Lucero Fernández, and M. Montanero

Difficulties Encountered In Introducing The Use Of Information Technology In Teaching By Young Years Computer-Assisted

Learning Center, Inc For The First School Year, June 1999 To March 2000

C. R. Perez, F. M. Zamora, A.C. Corona, and A.R. D. Paner

Digital Inclusion Program of the Government of Parana / Brazil

Almeida, N.P

Discourse analysis of blended teaching and learning and its implications for the teachers and students in Hong Kong

Zhichang Xu

Education in the Global Knowledge Society: Crossing Borders with the Intel® Education Initiative

T. Osburg and A. Todorova

Electronic tutorial for educational computer networks.

B. Sus and J. Guerra

Engaging Young Children in an Emergent Literacy Curriculum Using Microsoft® PowerPoint™: Development, Considerations, and Opportunities

C. Blum, H. P. Parette, and E. H. Watts

Evaluating elearning – from the satisfaction level to evidence of skills in the workplace

J. Reis Lagarto

Evaluation of the IKASYS programme

K. Santiago, J.F. Lukas, J. Etxeberria, and A. Gobantes

Examining online learning processes based on log files analysis: A case study

Galit Ben-Zadok, Arnon Hershkovitz, Rachel Mintz, and Rafi Nachmias

Formative and peer-to-peer evaluation using a rubric tool

M. Cebrián de la Serna

Gender awareness in media education

Jiří J. Pavlíček

ICT for Counseling and Careers Guidance Services

E. Palomba

ICT-based learning projects and programmes of ZAWiW

Ralph Schneider

Managing Storage Systems in an Educational Environment

F. Nunes, S. Falcão, and A. Carneiro

On-line course instructional design from the professors' pedagogic knowledge and technological abilities

L. McAnally-Salas1, G. Lavigne, and C. Armijo de Vega

Open Content as Reusable Learning Objects: Leveraging the Commons for Multimedia Instruction

Wan M. Fauzy and Nur Hussein

Organisational learning, real-time documentation and on-site analysis — towards intelligent organisations: a case study on team sport

O. Kivinen, J. Hedman, and P. Kaipainen

PC Architecture Learning through the Combination of Hardware Examination and the Use of System Information Software

L. J. Herrera, F. Rojas, R. García Bermúdez, H. Pomares, and A. Guillén

Personal information management

M. Cannaerts, R. Deslé, and F. Truyen

Project-based learning with ICT: changes in ecology classroom in primary school

G. Bautista and A. Escofet

Regional educational policy and their effects on pedagogical innovation supported by ICT integration in schools

J. Valverde Berrocoso, E. López Meneses, and J. Montero Melchor

RSS and Vodcasting for Undergraduate Design and Technology Students: Mobile Learning Scenarios, Issues and Challenges

M.R. Hepburn and A.R. Hodgson

School as a learning organisation: the specific contribution of the Information and Communication Technologies (ICT)

Paulo Cunha and António J. Neto

Studies in Assessment of Multi-Media Technology in Ways of Expression on Virtual Image

Shang-Tsung Yang and Yu-Ting Lin

The Relationship between Self Report of E-Class Use and Students' Perception at Democritus University of Thrace

N. Vernadakis, P. Antoniou, V. Deri, M. Giannousi, and E. Kioumourtzoglou
 The Specifics of the Teacher's Education Adapted Towards New Technologies
Felipa Lopes dos Reis and António Eduardo Martins
 The survey of using ICT for international cooperation administration in education
J. Fabuš and I. Kremeňova
 Theory, praxis and assessment of computer games for young schoolchildren
M.A. Paín, P. Edwards, E.M. Domínguez, and P. Reyes
 Two decades of ICT Policy in Education. Changing discourses. Changing practices?
A. Omellas, J. A. Sánchez Valero, K. Alonso and O. Molto
 Voting technology, PowerPoint and interactivity: problems and possibilities
T. Haydn
 Web system for the Academic Tutoring of Egressed Students
J.A. Pérez Mata, C. González Escalante, J.I. Benavides Benítez, J. Gómez Luna, and E.Herruzo Gómez

Pedagogical Strategies in ICT Education

A dynamic, web-based approach for developing intercultural communication
Gilberte Furstenberg
An Educational Strategy Based on Information Technologies and the Collaboration between Academy and Industry for Software Engineering Education and Training
R. Juárez-Ramírez, G. Licea Sandoval, C. Cabrera-González, and S. Inzunza-Soberanes
 Application of innovative instructional practices using ICTs to favour collaborative learning in Higher Education
I. Cuadrado Gordillo and I. Fernández Antelo
 Assessing assessment
P. Peres, M. Moreira Silva, and C. Tavares
 Back to the Future: The Power of Traditional Teaching with Modern Communication
B. Mulligan
 Challenging multiple perspectives within e-learning contexts: a scenario-based approach for the design of learning activities
M. Kordaki
 Designing Distance Hypermedia Courses
Amar Balla, Nabila Bousbia and Hakim Amrouche
 Embedded pedagogy in scripted-media objects—a partial solution to the reusability paradox
P.C. Whalley and K.A. Quick
 Embracing and enhancing ideas as a strategy for ICT education
E. Stefanova, P. Boytchev, N. Nikolova, E. Kovatcheva, and E. Sendova
 IICT model: a pedagogical strategie for education
S. Silva Cruz and A. Amorim Carvalho
Innovative-didactic program complex as a facility of realization of new paradigm in education
Yuldashev Z.Kh. and Ashurova D.N
 Knowledge or content? The philosophical boundaries in e-learning pedagogical theories.
N. S. A. Silva, G. J. M. Costa, S. Rogerson, and M. Prior
 Mastering skills using ICT: An active learning approach
N.M. van Diepen, Eliza Stefanova, and Malgorzata Miranowicz
 Personalisation of Learning
Kateřina Kostolányová, Jana Šarmanová, Jana Kapounová, and Ondřej Takacs
 The changing vision of an e-teacher: a retrospective
C. Armijo de Vega, L. McAnally-Salas, and S. Ojeda Benítez
 The Contextually-Partitioned Web: An Investigation into the Role and Use of Structured Collabularies in Digital Repositories as Information Filters to Improve the Web User's Experience
J. C. Samuel, J. M. Hinson, and J. L. Sanson
 The Copyright Law of e-Learning in Czech legal Frame
S. Hubackova and M. Ruzickova
 Time Management in E-learning
Tomas Foltýnek and Arnost Motycka
 Virtual Learning Space WebCT and Podcasting
S. Hubackova

Language Learning

A Software System for Learning the Vocabulary and Collocations: Results of a Training Experiment
Pavel Diachenko
 Asynchronous user communication and management tools in the InGenio e-learning platform
J. M. de Siqueira, A. Gimeno Sanz, and A. Martínez Sáez
 b-learning in classics: a pilot online course for the study of the ancient Greek grammar
D. Vlachopoulos and P. Gómez Cardó
 Concept of Educational Design for Serious Games
B. Holm Sørensen
 Contrast and validation of computer assisted language testing in Chinese students learning Spanish
J. M. de Siqueira, D. González, J. García Laborda, and T. Magal Royo
 Developing literary literacy: reading hyper-literature in English language classes
Rita Baleiro
 Multidisciplinary ICT based learning in practice

C. Tavares Ribeiro and C. Oliveira Martins

The inhibition of mother tongue interference in foreign language speech perception and production- a proposed solution for European university students

Anthony Stenton

The use of wikis in the writing of branching stories in a foreign language class

N. Moreno

ICT in Science & Engineering Education

A Descriptive e-Learning Environment for Mathematics

P. Semião

A methodology and a framework proposal for competitive learning in programming courses

R. Neves Madeira, Bruno Silva, and C. Grueau

A model for effective real-time entry of mathematical expressions

Marco Pollanen and Michael Reynolds

An Interdisciplinary Environment for Science Learning

S. Cuomo, B. D'Aniello, A. Murano, and E. Saulino

An on-line experiment: Solar Cell I-V Characterization

A. Neveu, A. Legendre, O. Martínez, J. Adiego, M. A. González and V. Parra

An On-line Introduction to Special Relativity with Experimental Support.

Anibal Rodriguez Gomez and Jonas Torres Montealban

Chemistry education with podcasts. Strategy and effectiveness

N. Miranowicz and M. Miranowicz

CmapTools free software Use for implementing Chemistry Concept Maps with Teacher Training Students

C. Aguirre Pérez

Collaborative Concept Mapping by Using CmapTools: Supporting Conceptualisation and Learning in Higher Education

M. Pehkonen, I. T. Koponen, and T. Mäntylä

Competency and skills training for Internet use of standards and procedures databases in the aeronautical industry

M. G. Del Rio-Cidoncha, J. Martínez-Palacios, R. Ortiz-Marin, L. García-Ruesgas, and M. L. Balsa-Anaya

Considerations on Pupils' Feedback Concerning the Use of Virtual Experiments in Science Teaching

L. M. Gorghiu, G. Gorghiu, C. Dumitrescu, R. L. Olteanu, A. M. Suduc and, M. Bizoi

Development of courseware for early school years' science education

Ana Cristina Torres and Rui Marques Vieira

Educational experiences with interactive whiteboard in teaching Natural Sciences

Małgorzata Bartoszewicz

Exploring Chemistry Using Virtual Instrumentation – Challenges and Successes

L. M. Gorghiu, G. Gorghiu, T. Alexandrescu, and L. Borcea

ICT – Competencies in Mathematics and Informatics

Hans-Stefan Siller and Karl Josef Fuchs

ICT use in science Education

B. Jarosievitz

Imparting psychomotor skills to the learners using computer aided instructions in Engineering Education

R. Mishra, S. Barrans, and C. Pislaru

Integrating Technologies in Linear Algebra Lectures

M. Pires and M. G. Marques

Interesting Chemistry – A Multimedia Task Collection Types of Inorganic Compounds

H. Gulińska

Interface design of a virtual laboratory for mobile robot programming

U. Borgolte

LON-CAPA - An Open-Source Learning Content Management and Assessment System for the Sciences

Gerd Kortemeyer

Multimedia software as support for a self-explaining visit path in science museum: the “Domus Archimedeia” experience.

M. Bianucci, R. Fieschi, L. Gambarelli, C. Mantovani, and S. Merlino

New Practices of Learning Using Adjustable Software

E. Rodrigues, J. Moreno, and D. Grilo

Playing with science in the kindergarten

C. P. Barbosa, M. C. Martins Gonçalves, A. A. Almeida, J. B. Oliveira, J. Miranda, J. Soares, P. Martins, D. R. Fernandes, R.

Fontes, M. A. Sá, A. Guerra, A. T. Esteves, R. Almeida, C. Leite and M. J. Martins

Promoting and teaching “hard” science in an amusing way: the “Domus Archimedeia” approach to Greek mathematics

M. Bianucci, R. Fieschi, L. Gambarelli, C. Mantovani, and S. Merlino

Simulated physics experiments developed in the frame of the VccSSe European project

W. Tlaczala, M. Mazanka, M. Zaremba, A. Zagorski, and G. Gorghiu

Strategies for a Web-based Mathematics Course

P. Semião

Student patterns of interaction in asynchronous online discussions: Implications for teaching and research

Judith B. Pena-Shaff

Study of uniform torsion in beams using matlab virtual laboratory

J.M. Martínez-Jiménez, P. Martínez-Jimenez, A. Martínez-Valle, JM Martínez-Valle, M. Varo Martínez,

and R. Castro Triguero

Using ICT to enhance knowledge about sound

Maria Teresa Soares and Paulo Cunha

Using VLEs to support student centred learning in Control Engineering Education

C. Pislaru and R. Mishra

Virtual environment for the management of mathematical knowledge

A. Soberanes Martín and M. Martínez Reyes

Virtual physics laboratory for distance learning developed in the frame of the VccSSe European project

W. Tlaczala, M. Zaremba, A. Zagorski, and G. Gorghiu

Technologies in the Service of Education

50% Increase in the Use of Information Technology and Multimedia and Its Implication To Batch 2006 At Young Years Computer-Assisted Learning Center, Inc. Tiaong Quezon Philippines

N. V. Malabanan, O.C. Evangelista, R. E. Pangantijon, and M.L. Enriquez

ADVISOR®: Towards Holistic Model-Based e-Learning Environments Based On Meta-Modelling Concepts

Wilfrid Utz, Vedran Hrgovic, and Dimitris Karagiannis

Aiding Academics to move from knowledge management to knowledge creation: Conceptualisation of a Personal Academic Environment (PAE)

D. Casanova, B. Holmes, and I. Huet

Automated skills assessment in mobile environment

Katarína Jelemenská, Matej Jurkovič, Peter Pišteň, and Pavel Čičák

Building virtual educational environment

J. Mattila, S. Federley, J. Horelli, and M. Väänänen

Computer Supported for Practicing Text Understanding in Pairs

Sara Streng, Karsten Stegmann, Jonas Koch, Heinrich Hussmann, and Frank Fischer

Courseware Sere: Technical and Didactic Evaluation

António Pedro Costa, Maria João Loureiro, Luís Paulo Reis, Patrícia Sá, Cecília Guerra, and Rui Vieira

Design and Architecture of an Integrated E-learning Environment. Case Study on Babes-Bolyai University, Cluj-Napoca, Romania

Alina Andreica

Developing the e-Learning-oriented e-Assessment

G. Rodríguez Gómez (Coord.), M.S. Ibarra Sáiz, J.M. Dodero, M.A. Gómez Ruiz, B. Gallego Noche, D. Cabeza Sánchez, V.

Quesada Serra, and Álvaro Martínez del Val

E-study resources: How we can design them for re-use in many situations?

M. Drozdova and K. Pilatova

Governance and management in the universities. Ict for decisional processes

Maria Grazia Simone and Giuseppina Marselli

Hyperdocuments: the making of a digital pedagogical material

Carlos E. Padilha Severo, A. M. Bulegon, Eunice M. Mussoi, M. L. Pozzatti Flores, and José Valdeni de Lima

Identity technologies for worldwide integration in collaboration and eLearning tools

J. A. Accino Domínguez

Improving creative thinking abilities using a generic collaborative creativity support system

Florian Forster

Including Media Education in the curricula: a DVD to help teachers and students in school newspapers production

M. Helena Menezes and V. Nabais Tomé

Innovations for Current Technology Enhanced Learning Systems

Z. Bizonova, M. Kardos, K. Mailet, and K. Pilatova

Mobile Learning Using Text-To-Speech Technologies

O. Zbozhna, H.-R. Vatterrott, A. Martens, and D. Tavangarian

Multilevel Collaborative Framework for Implementation of E-learning System.

S.G. Jadha and G. N. Shinde

Organization of the argumentative text in a blended-learning environment

A. de Sousa de Pinho and L. Álvares Pereira

Safeguarding the User - Developing a Multimodal Design for Surveying and Raising Internet Safety and Security Awareness.

L. Gjedde, R. Sharp, P. Andersen, and H. Meldgaard

Semantic Annotation and Tagging in the KP-LAB environment: mining the learning and knowledge dynamics.

A. Locoro, A.M. Scapolla, D. Grignani

Specifications and standards for use of educational digital content

Alenka Kavčič

The retrieval of educational contents in mass media

María Luisa Sevillano García, Raquel Varela Méndez, and Sonia Santoveña

Tools for Synchronous Communications in Collaborative Knowledge Practices Environment (KPE)

I. Furnadzhiev, V. Tchoumatchenko, T. Vasileva, M. Lakkala, and M. Bauters

VirtLab: Virtual Laboratories in Federated Environments

José Quintino Rogado

Virtual environment in Civil Engineering education: Construction of a wall, a bridge and a roof

Alcínia Z. Sampaio, Pedro G. Henriques and Carlos O. Cruz

Visual Model Editor for Supporting Collaborative Semantic Modeling

C. Richter, H. Allert, V. Tchoumatchenko, T. Vasileva, L. Ilomäki, and Kari Kosonen

Virtual Worlds

Exploring the real possibilities for virtual conferencing during student teacher field experiences

Kathleen Nolan and Art Exner

Knowing culture in Second Life: international literacy and the technological know how in a virtual world

Sean William John McMinn

Virtual reality on the web: the 21st Century World project

Nicoletta Adamo-Villani, Eric Johnson, and Tyler Penrod

Games

A method to assess collaboration during the learning by means of video games

N. Padilla Zea, J. L. González Sánchez, and F. L. Gutiérrez

How To Take Care of an Alien? New Multimedia Games for Teaching Algorithmic Concepts in Primary Schools

M. Weigend

Learning experiences by using video game consoles

M. Garay Serrano, M. Gaspar Rodríguez, J.E. Agudo Garzón, and H. Sánchez Santamaría

e-Portfolio

Electronic portfolios in teacher education: Does sequence matter?

S. D. Arnold and D. De Vito

E-portfolio : a pedagogical tool for the design of personal and professional student project

S. Mailles-Viard Metz and H. Albernhe-Giordan

Evaluation of learning based on transverse competences. Design and development of the etransfolio in an online university

E. Barberà, G. Aguado, and A. Roderà

Portfolios for Business English

Lut Baten

The practical application of e-portfolio at the Open University of Catalonia: assesment of competence based learning.

Elena Barberà, Magí Almirall and José Mora

Tutorial experience on learning environments using e-portfolio

M. G. Del Río-Cidoncha, J. Martínez-Palacios, L. García-Ruesgas, and R. Ortiz-Marin

Playing with science in the kindergarten

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A DVD was created for kindergarten educators, describing a set of activities/experiments based on basic principles and techniques of Chemistry and Physics and organized in 7 main chapters: 1. Colour, translucency, opacity and transparency; 2. Gravity, weight, mass, volume, density, area, space and shape of bodies; 3. Solubility, miscibility, density and buoyancy; 4. Magnets and magnetism; 5. Static electricity; 6. Air, atmospheric pressure, gas and sound; 7. Solid state, liquid state and gaseous state, hot and cold, to heat and to cool.

Keywords simple science experiments; DVD; kindergarten

1. Introduction

In recent years, following the desire to make positive changes in the training of children and young people, the politics of education in Portugal have stated the importance of the input in Science and experimental method. Science could and should be used in kindergarten, but in a simple and pleasant way, to expand the knowledge and understanding that children have of the biological and physical world, and to help them develop more effective and systematic means of discovery. Early contact with Science has been emphasized by the fact that it helps to develop intellectual, social and moral children.

A DVD was created for kindergarten educators (as a "*Science in the kindergarten*" workshop support tool) describing activities/experiments based on basic principles and techniques of Chemistry and Physics. The DVD is organized in 7 main chapters, and experiments can be carried out almost entirely with "*equipments/materials and reagents*" easily found either in kindergarten or at home. Two minor chapters were also included in the DVD providing all the educational and scientific aims as well as bibliographic references.

2. Educational and scientific features of the project

The environment and daily leisure time in kindergarten provide powerful and distinct opportunities to explore, taking advantage of the children's interest in the world around them. So, the combination of science and fun was organized into sets of simple activities/experiments designed to promote an active and meaningful construction of knowledge, where the steps of the scientific process/method can and should be applied in their resolution.

Activities/experiments will promote verbalisation of ideas/hypothesis/problems/doubts, encourage partnerships and working together for their accomplishment, facilitating children decentralization, acceptance and/or discussion of others' opinions as well as the sharing of "*equipments/materials and reagents*".

2.1 Orientations for (aims of, guidance for) kindergarten educators when performing the activities/experiments

Lead the child to ask questions, raise problems, formulate hypothesis and look for the solutions (the basis of scientific method development). Awaken the child's awareness for daily circumstances, for which she does not have answers/explanations in order to direct the search for explanations and to the formulation of hypothesis. Help the child verifying (new/recently formulated) hypothesis, resorting to observation and to experimentation. Compare the child's perspectives with the vision given by the educator. Increase the child's knowledge by performing new investigations. Help the child to build more rigorous concepts based on the initial knowledge.

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2.2 Simple and direct consequences for children when carrying out the activities/experiments

Development of visual-motor coordination. Improvement of the ability to perform activities. Improvement of manual skills and fine motricity. Development of physical knowledge about material objects (to know how to nominate and adequately use tools and equipments of different kinds, exploring different possibilities as an introduction to Science). Development of the cause-effect connection/notion. Perception of constancy and preservation of objects' properties and connections/relationships. Initiation to the concept of size and measurement activities. Achievement of the observation of the experiment, experimental practice and register of occurrences [using tables and other supports (labels, free drawings and wording of texts) as a form of registration/recording]. Contribution to the organization and systematisation of recently acquired knowledge.

3. DVD main structure and organization: description and justification

The DVD is organized in 7 main chapters: 1. Colour, translucency, opacity and transparency; 2. Gravity, weight, mass, volume, density, area, space and shape of bodies; 3. Solubility, miscibility, density and buoyancy; 4. Magnets and magnetism; 5. Static electricity; 6. Air, atmospheric pressure, gas and sound; 7. Solid state, liquid state and gaseous state, hot and cold, to heat and to cool. Where appropriate, relationships/links among the subjects/activities/experiments of each chapter were pointed out.

The activities/experiments (originals or collected from the literature) proposed in each chapter of the DVD can be carried out almost entirely with "*equipments/materials and reagents*" easily found either in kindergarten or at home. Therefore, children can, easily, become teachers of their close family regarding what they have done/learnt in the kindergarten. This "*reproduction*" made by children, at home, will strengthen the recent acquired knowledge and exercise or identify doubts about what they have done in the kindergarten.

Each chapter of the DVD presents, at the beginning, the appropriate scientific "*words/names/vocabulary*" that educators should introduce into their language when performing the activities/experiments with children, which will substantially increase children's vocabulary, at the most appropriate age. Very early in their development children will start using vocabulary that is familiar in higher levels of education, at which time they will pay more attention since they already heard and were introduced to.

Most of the scientific experiments presented, in each chapter of the DVD, were based on simple every day situation. Children will be introduced to scientific process, to Science, through the urge to obtain answers, to solve/interpret a daily problem/situation. Hopefully, the joy of discovery will motivate children to be interested in Science. Fun manual work and "*magical experiments*" were also included, sequentially, in each chapter. Children's motivation to participate and communicate is increased when something exciting happens.

Photographs and short videos (all originals) of some of the experiments were included in each chapter of the DVD (with a random distribution among each of the three activity levels of each chapter). Also children's free drawings of some of the activities/experiments were included in some of the chapters. Videos were filmed both in "*laboratorial*" and "*kindergarten*" environments. However those recorded with children were not included in the DVD, for children's safety and anonymity, but just shown in the workshop for kindergarten educators.

Each chapter of the DVD presents, at the end, a list of both educational and scientific specific aims, according to the chapter physical and/or chemical subject, followed by examples (in the form of questions) of every day situation that introduce some of the experiments and concepts.

Simple explanations of the chemical and physical concepts of the experiments were provided in each chapter, so that educators can fully understand the experiments and, at the same time, acquire the necessary scientific background to modify/adapt/change them in the future. Additionally, educators will learn the correct scientific "*words/names/vocabulary*" to each step of the activities/experiments described and extrapolate to new every day situation to which they could come across.

4. Two examples

4.1. Regarding colour

Some of the questions suggested to start activities/experiments of chapter 1 (Colour, translucency, opacity and transparency) are: "What around us does posses colour?" and "How can we create colours?".

Food and animals (for example drinks and birds, respectively) can be very colourful. Consumption of soft drinks (Figure 1), in a glass, during a sunny afternoon (Figure 2), while constructing birds made of paper (Figure 3) can be associated with colour activities/experiments.



Fig. 1 Emergence of a green colour by mixing a yellow soft drink with a blue one.

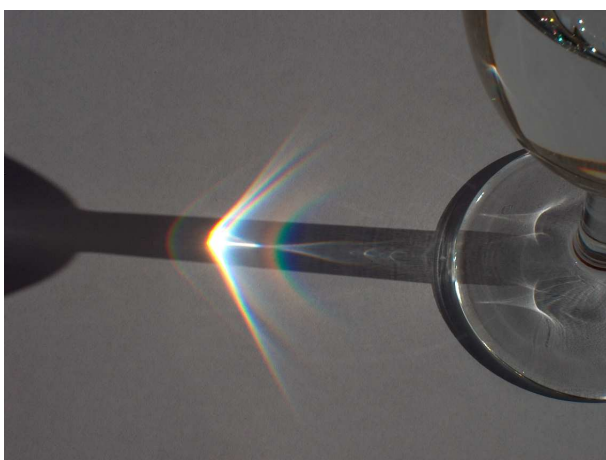


Fig. 2 Sun light decomposition, using a glass filled with water. The rainbow is obtained by sun light refraction and dispersion, by propagation through glass and water.



Fig. 3 Composition or decomposition of colours using a bird made of paper, constructed according to an origami scheme (A), by adding small drops of a liquid (water in this case; but ethanol or vinegar could be used) into the drawings in the bird wings (B and C). Decomposition/separation of colours is achieved by performing paper chromatography.

4.2. Regarding magnetism

One of the questions suggested to start activities/experiments of chapter 4 (Magnets and magnetism) is: “How do small travel souvenirs hold to the refrigerator door?”.

Objects that stick to the refrigerator door can be used (or laboratorial magnets instead) in the classroom to identify some materials that are attracted by magnets (Figure 4). Magnets can also be used to create colours (Figure 5).

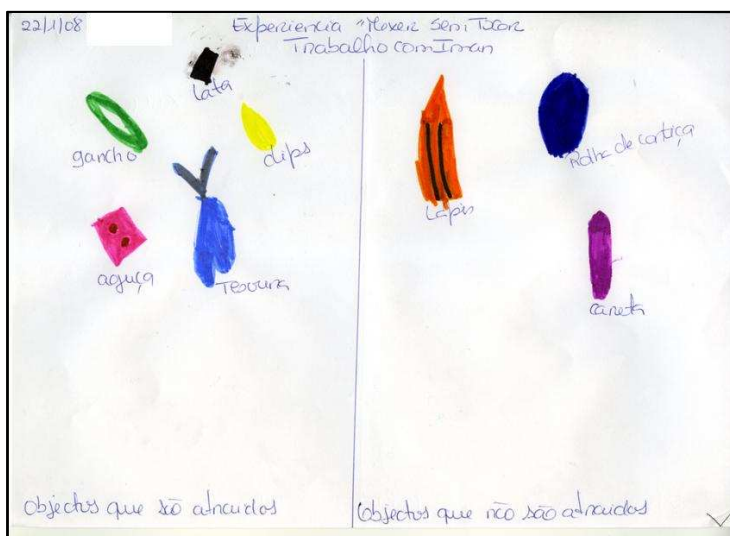


Fig. 4 Free drawing, made by a child (5 years old), identifying what is (on the left) and what is not (on the right) attracted by a laboratorial magnet (hair-pin, tin, clip, pencil-sharpener and scissor on the left; pencil, cork and pen on the right).



Fig. 5 Two laboratorial magnets are used to mixture food colourings: the movement of a magnet over a sheet of white paper (directed by the movement of a second magnet under the metal tray) composed colours by mixing some drops (over the paper) of yellow, red and blue food colourings.

5. Conclusions

In short, the proposed activities/experiments will enable the development and stimulation of: a) scientific curiosity, b) scientific and experimental attitudes, c) organizational skills, d) decentralization and sharing, e) attention, concentration and memory, f) vocabulary, g) logical thinking [as a consequence of generation of cognitive conflict (search for answers)], h) sensing and perception as well as encourage the creation of artistic productions.

Educators are provided with the necessary scientific background to rigorously introduce basic chemical and physical concepts and vocabulary to children in the kindergarten, as simple and funny activities/experiments.

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The full list of references is provided in the DVD. Here the authors provide only the pedagogic ones.