

SEZIONE 6: FISICA GENERALE, DIDATTICA E STORIA DELLA FISICA

TAVOLA ROTONDA: La ricerca didattica italiana nei Progetti Europei

# L'integrazione del Progetto ESTABLISH nel contesto della Scuola italiana

Claudio Fazio

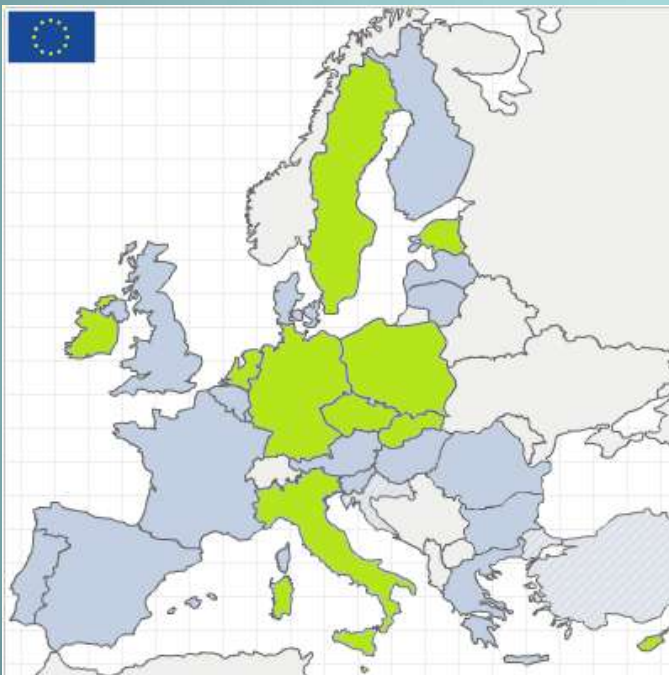
UOP\_PERG (University of Palermo, Physics Education Research Group)

Dipartimento di Fisica e Chimica, Università di Palermo

# Il Progetto ESTABLISH



14 Università ed Enti di Ricerca da 11 Paesi Europei, per un impegno di 48 mesi, a partire dal 1 gennaio 2010



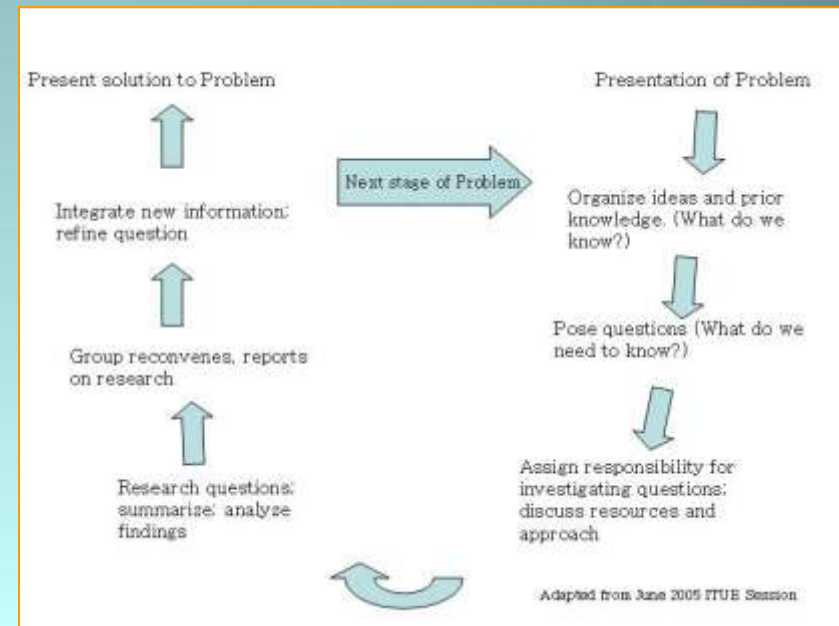
**Promuovere e sviluppare la “Inquiry Based Science Education” (IBSE) nelle Scuole Secondarie**

# Inquiry Based Science Education

“Per “Inquiry” si intende un processo di esplorazione attiva, tramite il quale vengono messe in atto abilità critiche, logiche e creative per porre domande su situazioni di interesse specifico e impegnarsi a dare risposte a tali domande.

Il processo di “Inquiry” aiuta a mettere in relazione le conoscenze pregresse con le nuove esperienze, a modificare e accomodare le idee preconcepite e i modelli concettuali e a costruire nuova conoscenza.”

(da Douglas J. Llewellyn, 2002)



# Attività di formazione/apprendimento basate sull'Inquiry all'Università di Palermo



Introduzione alle metodiche Inquiry-Based.

<http://www.establish-fp7.eu>

22 docenti di  
Scuola  
Secondaria  
impegnati  
nell'a.s.  
2010/2011

search

European Science and Technology in Action:  
Building Links with Industry, Schools and Home

**Main Menu**

- » Home
- » About the Project
- » About the Partners
- » Teacher Conference 2012
- » Teacher Professional Development
- » Dissemination
- » Events
- » Contact Us

**ESTABLISH Teacher Education Programme**

ESTABLISH aims to facilitate innovations in classrooms practice through the involvement of these stakeholders in the development, piloting and provision of appropriate teaching and learning IBSE units (informed by scientific and industrial communities) together with appropriate supports for both in-service and pre-service teachers to implement IBSE.

At present the consortium members, have developed and run education programmes to support teachers' use of inquiry-based approaches in their teaching practices, delivered face-to-face and online.

Each Teacher Education Programme (TEP) has been informed by an [agreed framework](#) which sets out a number of TEACHING ELEMENTS and LEARNING OBJECTIVES, with suggested materials and activities from the ESTABLISH Teaching and Learning Units, that have been identified as being essential and supportive for teaching using IBSE. These TEP are currently being prepared as short online programmes and will be made available soon on the ESTABLISH e-platform.

- [ESTABLISH TEP I-IV \(CORE ELEMENTS\)](#)
- [ESTABLISH TEP V-VIII \(ADDITIONAL ELEMENTS\)](#)

The implementation report of ESTABLISH TEPs and the descriptive stories (narratives) of these TEPs have outlined a number of models due to varying cultural and local contexts, but all are focused on supporting the teachers to become proficient and confident in their own IBSE teaching.

**Members Menu**

- » LATEST UPLOADS
- » WP1 - Selection of core teaching and learning IBSE units
- » WP 2 - Involvement of strategic partners
- » WP 3 - Evaluation, adaptation and pilot

# Attività di formazione/apprendimento basate sull'Inquiry all'Università di Palermo

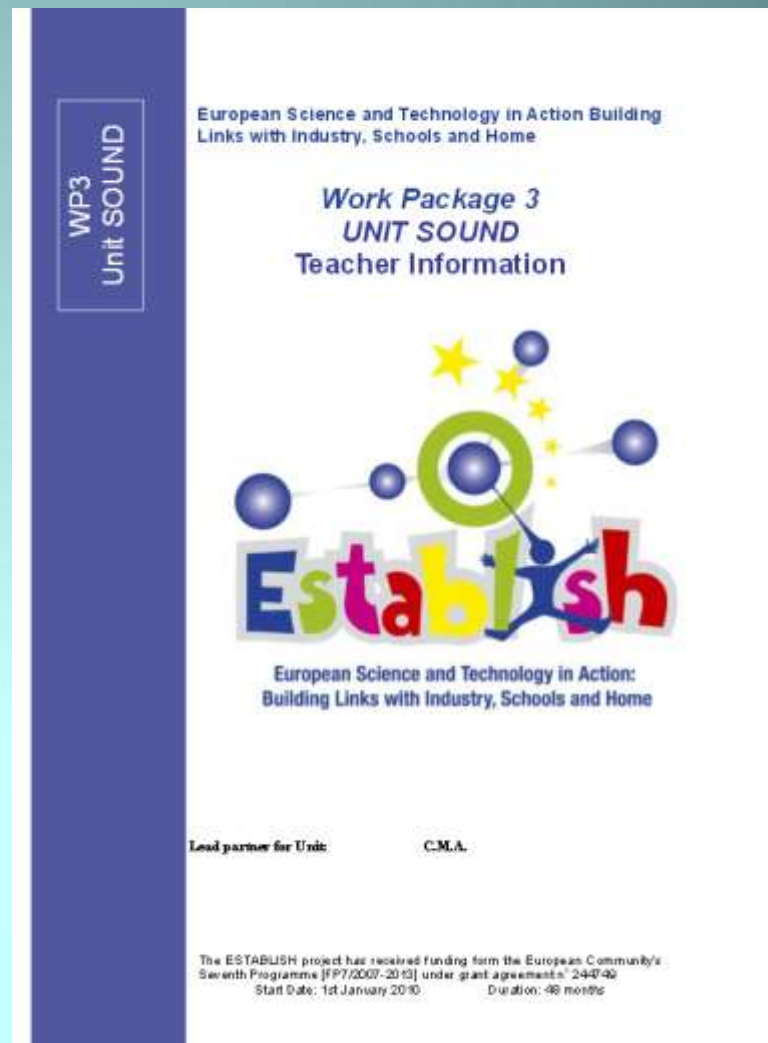


Analisi critica di una Unità di lavoro presentata dai partner:

## Sound

Università di Amsterdam – Centre for Microcomputer Applications (Paesi Bassi)

22 docenti di Scuola Secondaria impegnati nell'a.s. 2010/2011



# Attività di formazione/apprendimento basate sull'Inquiry all'Università di Palermo



Sviluppo e sperimentazione di una Unità di lavoro:

Progettiamo una Casa a Basso Consumo Energetico (PCBCE)


*Un approccio Inquiry-Based ai fenomeni termici per la Scuola Secondaria di I e II grado*

22 docenti di Scuola Secondaria impegnati negli a.s. 2010/2011 e 2011/2012

WP3  
Designing a Low Energy Home: heating and

European Science and Technology in Action Building Links with Industry, Schools and Home

**Work Package 3**  
**PROGETTIAMO UNA CASA A BASSO CONSUMO ENERGETICO**



European Science and Technology in Action:  
Building Links with Industry, Schools and Home

Lead partner for deliverable: UNEPA  
Version: 1.1 - ITA

The ESTABLISH project has received funding from the European Community's Seventh Programme (FP7/2007-2013) under grant agreement n° 244749  
Start Date: 1st January 2010 Duration: 48 months



# Attività di formazione/apprendimento basate sull'Inquiry all'Università di Palermo



Sperimentazione di tre Unità di lavoro:

La donazione del sangue

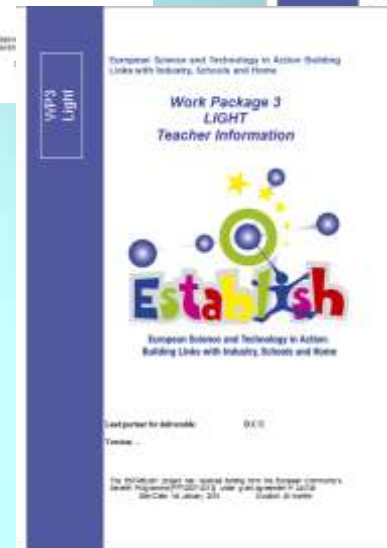
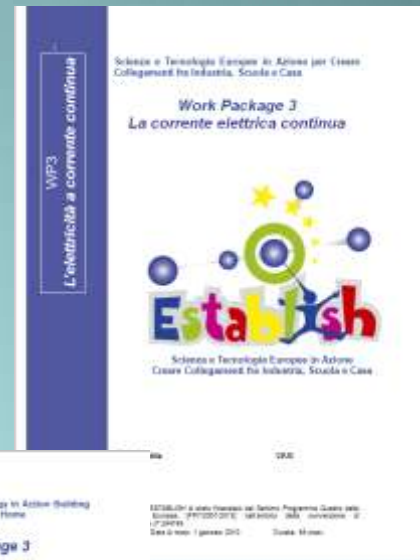
La corrente elettrica continua

Università di Kosice (Rep. Slovacca)

La luce

Università di Dublino (Irlanda)

22 docenti di Scuola Secondaria impegnati negli a.s. 2012/2013



## Obiettivi specifici e metodi di ricerca

- Studiare l'efficacia, nella scuola italiana, di *Ambienti di apprendimento basato sull' Inquiry* nel:
  - favorire la modifica delle conoscenze spontanee persistenti in fisica;
  - aiutare gli studenti di tutti i livelli scolari a superare le difficoltà che incontrano nell'applicare le conoscenze teoriche a problemi di vita reale;
  - rinforzare le capacità di ragionamento degli studenti e le loro abilità nello sviluppo di un esperimento scientifico e, più in generale, nello sviluppo di attività il più possibile simili a quelle di ricerca.



## Obiettivi specifici e metodi di ricerca

- Costruire, insieme con docenti e studenti, materiali (schede di formazione/lavoro per i docenti, schede di lavoro per gli studenti, fogli di lavoro per l'analisi dati e la costruzione di modelli, ... ) per la sperimentazione sul campo degli ambienti costruiti
- Analizzare le risorse cognitive messe in opera *da docenti e da studenti* quando coinvolti in attività di tipo Inquiry
- Utilizzare metodi di ricerca qualitativa e quantitativa per l'analisi dei dati delle sperimentazioni
- Raccogliere dati per verificare l'utilità dell'approccio Inquiry-Based ai vari livelli scolari

# Attività di apprendimento basate sull'Inquiry all'Università di Palermo



**5 giornate di  
formazione con  
insegnanti:**

28, aprile 2010  
11 nov. 2010  
7 aprile 2011  
17 nov. 2011  
14 dic. 2011

**3 giornate di  
revisione con gli  
insegnanti:**

28 marzo 2012  
29 marzo 2012  
30 marzo 2012

**3 giornate di discussione sui  
risultati ottenuti durante la  
sperimentazione in classe:**

3 maggio 2012  
30 maggio 2012  
31 maggio 2012

**Prodotto:**  
Prima versione  
ufficiale dell'Unità  
PCBCE

**Prodotto:**  
Versione rivista  
dell'Unità

**Prodotto:**  
Report sulle  
sperimentazioni

# Attività di disseminazione



5 cicli di seminari/workshop per docenti di scuola secondaria, condotti dai docenti già formati durante le attività di ESTABLISH

Novembre 2011 – giugno 2013

## Seminari-Workshop

**IBSE in classe**

**V Ciclo: PROGRAMMA**

**IBSE in classe**

**IV Ciclo: PROGRAMMA**

**IBSE in classe**

**III Ciclo: PROGRAMMA**

**IBSE in classe**

**I-II Ciclo: PROGRAMMA**

## Altre attività formative



Partecipazione di 10 docenti del gruppo alla “Teacher Conference” tenutasi a Dublino dal 7 al 9 giugno 2012



Teacher Conference - Dublin 7<sup>th</sup>-9<sup>th</sup> June 2012



SMEM 2012  
Science and Mathematics  
Education Conference

*Teaching at the heart of learning*

Dublin City University, Ireland  
7<sup>th</sup> - 9<sup>th</sup> June 2012

[Poster 1](#)

[Poster 2](#)

[Poster 3](#)

[Poster 4](#)

[Poster 5](#)



# INQUIRY BASED SCIENCE EDUCATION STUDENTS OF 1° YEAR SECONDARY SCHOOL DESIGN A LOW ENERGY HOME

Daniela Bellomonte e Laura Gambino

### 1. How to keep warm your house model

#### DIPLORC AND DPLAIN

**Activity:** Five groups of students are provided with different house models, heating the same dimensions and each student will offer an outdoor lamp, lamp to use, most suitable for each house model. The students will observe the temperature inside the house model.



**Results:** Five groups of students are provided with different house models, heating the same dimensions and each student will offer an outdoor lamp, lamp to use, most suitable for each house model. The students will observe the temperature inside the house model.

#### CLASORATE

**Activity:** All groups of students, having identified the model of the house, will observe the temperature inside the house model.

### 2. How is temperature distributed inside your house model?

**Activity:** Five groups of students are provided with different house models, heating the same dimensions and each student will offer an outdoor lamp, lamp to use, most suitable for each house model. The students will observe the temperature inside the house model.



#### CLASORATE

**Activity:** All groups of students, having identified the model of the house, will observe the temperature inside the house model.

### 3. What is the effect of sunlight on the temperature inside your house model?

**Activity:** Five groups of students are provided with different house models, heating the same dimensions and each student will offer an outdoor lamp, lamp to use, most suitable for each house model. The students will observe the temperature inside the house model.



#### CLASORATE

**Activity:** All groups of students, having identified the model of the house, will observe the temperature inside the house model.

# INQUIRY BASED SCIENCE EDUCATION DESIGNING A LOW ENERGY HOME: STUDENTS LEARN HOW THERMAL ENERGY TRANSFERS BETWEEN SYSTEMS

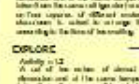
Daniela Bellomonte e Laura Gambino

### Conduction

#### 1. Observing ice melting in phases of different materials

##### DIPLORC

**Activity 1.1**  
 A lot of the water of almost the same dimension and of the same temperature, but different from the same temperature, is placed on five samples of different materials. The observations are made to arrange the plots according to the best insulation.



**Activity 1.2**  
 A lot of the water of almost the same dimension and of the same temperature, but different from the same temperature, is placed on five samples of different materials. The observations are made to arrange the plots according to the best insulation.



**Activity 1.3**  
 The type 1.3 shows the results. The observations are made to arrange the plots according to the best insulation.



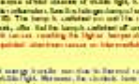
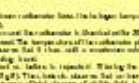
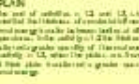
**Activity 1.4**  
 The type 1.4 shows the results. The observations are made to arrange the plots according to the best insulation.



**Activity 1.5**  
 The type 1.5 shows the results. The observations are made to arrange the plots according to the best insulation.



**Activity 1.6**  
 The type 1.6 shows the results. The observations are made to arrange the plots according to the best insulation.



#### 2. Measuring insulation properties of different materials

##### DIPLORC

**Activity 2.1**  
 Five different groups of students are provided with equal polypropylene samples, measuring the amount of heat loss of the water. The results are arranged in a graph according to the best insulation.



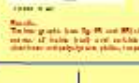
**Activity 2.2**  
 The type 2.2 shows the results. The observations are made to arrange the plots according to the best insulation.



**Activity 2.3**  
 The type 2.3 shows the results. The observations are made to arrange the plots according to the best insulation.



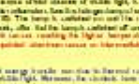
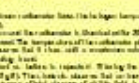
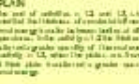
**Activity 2.4**  
 The type 2.4 shows the results. The observations are made to arrange the plots according to the best insulation.



**Activity 2.5**  
 The type 2.5 shows the results. The observations are made to arrange the plots according to the best insulation.



**Activity 2.6**  
 The type 2.6 shows the results. The observations are made to arrange the plots according to the best insulation.

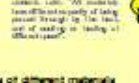


#### DIPLORC

**Activity 1.1**  
 A lot of the water of almost the same dimension and of the same temperature, but different from the same temperature, is placed on five samples of different materials. The observations are made to arrange the plots according to the best insulation.



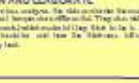
**Activity 1.2**  
 A lot of the water of almost the same dimension and of the same temperature, but different from the same temperature, is placed on five samples of different materials. The observations are made to arrange the plots according to the best insulation.



**Activity 1.3**  
 The type 1.3 shows the results. The observations are made to arrange the plots according to the best insulation.



**Activity 1.4**  
 The type 1.4 shows the results. The observations are made to arrange the plots according to the best insulation.



**Activity 1.5**  
 The type 1.5 shows the results. The observations are made to arrange the plots according to the best insulation.



**Activity 1.6**  
 The type 1.6 shows the results. The observations are made to arrange the plots according to the best insulation.



#### DIPLORC

**Activity 1.1**  
 A lot of the water of almost the same dimension and of the same temperature, but different from the same temperature, is placed on five samples of different materials. The observations are made to arrange the plots according to the best insulation.



**Activity 1.2**  
 A lot of the water of almost the same dimension and of the same temperature, but different from the same temperature, is placed on five samples of different materials. The observations are made to arrange the plots according to the best insulation.



**Activity 1.3**  
 The type 1.3 shows the results. The observations are made to arrange the plots according to the best insulation.



**Activity 1.4**  
 The type 1.4 shows the results. The observations are made to arrange the plots according to the best insulation.



**Activity 1.5**  
 The type 1.5 shows the results. The observations are made to arrange the plots according to the best insulation.



**Activity 1.6**  
 The type 1.6 shows the results. The observations are made to arrange the plots according to the best insulation.

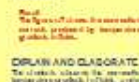


### Convection

#### Observing convection currents

##### DIPLORC

**Activity:** A lot of the water of almost the same dimension and of the same temperature, but different from the same temperature, is placed on five samples of different materials. The observations are made to arrange the plots according to the best insulation.



**Activity:** A lot of the water of almost the same dimension and of the same temperature, but different from the same temperature, is placed on five samples of different materials. The observations are made to arrange the plots according to the best insulation.



### Thermal Radiation

#### Build and use home-made radiometers

##### DIPLORC AND DPLAIN

**Activity:** A lot of the water of almost the same dimension and of the same temperature, but different from the same temperature, is placed on five samples of different materials. The observations are made to arrange the plots according to the best insulation.

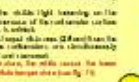


**Activity:** A lot of the water of almost the same dimension and of the same temperature, but different from the same temperature, is placed on five samples of different materials. The observations are made to arrange the plots according to the best insulation.



##### DIPLORC AND CLASORATE

**Activity:** A lot of the water of almost the same dimension and of the same temperature, but different from the same temperature, is placed on five samples of different materials. The observations are made to arrange the plots according to the best insulation.



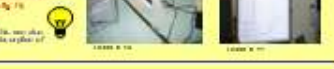
**Activity:** A lot of the water of almost the same dimension and of the same temperature, but different from the same temperature, is placed on five samples of different materials. The observations are made to arrange the plots according to the best insulation.



**Activity:** A lot of the water of almost the same dimension and of the same temperature, but different from the same temperature, is placed on five samples of different materials. The observations are made to arrange the plots according to the best insulation.



**Activity:** A lot of the water of almost the same dimension and of the same temperature, but different from the same temperature, is placed on five samples of different materials. The observations are made to arrange the plots according to the best insulation.



**Activity:** A lot of the water of almost the same dimension and of the same temperature, but different from the same temperature, is placed on five samples of different materials. The observations are made to arrange the plots according to the best insulation.





Scuola secondaria di 1° grado "Gregorio Russo" Palermo

# "Like a scientist" Experience in a Secondary School: "Gregorio Russo" Palermo, Sicily

M. Tumbolo, M.L. Modesto, C. Bianna

## Introduction

Year	1st	2nd	3rd year
Primary school	40	40	40
Secondary school	20	20	20

The secondary school "Gregorio Russo" is situated in a poor suburban district in Palermo. The experiment has been made with two classes of 1° degree secondary school, 12 students of 2nd year, and 14 students of the last year.

In the work package "Designing a low energy home heating and cooling", realized by University of Palermo, teachers selected two subjects for both classes.

Subject	Activity
Thermal energy	Activity 1.1: How is the temperature distributed inside your house model?
Thermal energy	Activity 1.2: How is the temperature distributed inside your house model?

Due to their poor cultural background and general low ability, the students were not curious and therefore the selected subjects were modified by School teachers, in order to simplify student's work. Prof. C. Bianna and M. Tumbolo, realized for some subjects easier student worksheets for each activity, instead, Prof. M. L. Modesto, who has younger student, decided to work by interactive demonstration for all activities.

## Starting up...

The project was carried out in 5 lessons (two hours each one). Some experiments were repeated twice because they turned out too difficult for the students.

### First step: Motivation

In order to increase student's involvement, teachers introduced the Establish Project, underlining the importance of student's work to implement the unit.

### Second step: Instruments

Teachers organized a Preliminary Unit, aimed at engaging students in scientific work: the scientist uses instruments to take measures, so students had the opportunity to know the activities, use thermal sensors in a free activity and discuss with the teachers the resulting graphs. Moreover teachers showed a Power Point Presentation "Designing a low energy home" with pictures of different type of houses, for stimulating the students to investigate how thermal energy flows through different materials.



## Experience

### First lesson: Activity 1.1

Model of how to keep your house warm

#### 1° class

The students were divided into two groups. Each group had to test two house models constructed with different materials (wood and polystyrene). During the activity students were given a worksheet prepared by the teachers, in order to realize an Interactive Demonstration.



2° class  
The teacher carried out the activity with the whole class. The teacher prepared a worksheet to carry out the experiment. Three students took notes on their science book.

### Second lesson: Activity 1.2

How is the temperature distributed inside your house model?

#### 1° class

The students were divided into two groups, one group worked with a wood house model and the other with a polystyrene house model. Each group was requested to analyze temperature distribution inside the house. A guided inquiry was proposed, starting with a discussion, in order to identify factors and design an appropriate experiment. The students didn't find difficulties in imagining number and position of the thermal sensors and easily realized the experiment.

#### 2° class

All students had fun to assemble the model home. The teacher put to them key-questions to start the discussion and to find the way to carry out the experiments. The students' arguments were interesting, but they sometimes had no sense. During the experiment the students were interested to follow the graphic and to touch the material and they also thought over their experiences. The teacher stimulated them to record data and then to make a representation of results and to give an explanation.



### Third lesson: Activity 2.1

Observing ice liquefying in plates of different materials

#### 1° class and 2° class

Teachers planned an interactive demonstration with the whole class. Students were initially requested to make a hypothesis on ice liquefying time over each kind of substratum. Most of the students' prediction were wrong. After the demonstration, students were requested to give an explanation about the observed phenomena. The teachers guided the students to correct experimental measures to a reasonable mode. The synergic work of student was fundamental to reach the final mode. This activity resulted the most difficult, for the high abstraction level required, probably will need an easier worksheet.



### Fourth lesson: Activity 2.2

Measuring insulation properties of different materials

#### 1° class and 2° class

The students were divided into two groups. Each group had to make insulation assessments, putting plates of different materials in cups with hot water. One group worked with plates of aluminum and the other with plates of polystyrene. In order to make these activities easier and to relate it with the last one, teachers prepared a worksheet with a series of key questions in order to guide them with their research. Finally students were able to make assessments on their own about insulation material's properties in order to make a low energy home.



# Shedding light! A comparison of two teaching methods

Carmela Di Stefano

## Introduction

Objective: to evaluate efficacy differences between the GSE method and the traditional method of teaching

### Traditional Approach

Although the discussion of this subject can be enriched with a variety of multimedia training aids and laboratory activities (almost always related to the verification of a law and hardly ever of discovery) the teacher's explanation followed by homework plays a key role in the learning process.

### Activities

1. Sources of light
2. How does light travel?
3. Understanding shadows
4. Exploring white light and filters
5. Exploring primary colours
6. Investigating mirrors
7. Investigating reflection, investigating Snell's law
8. Investigating lenses: Studying lenses
9. Using Diffraction



A large amount of time spent on the subject has been widely rewarded by a deeper understanding of the fundamental concepts and by the acquisition of investigating competencies as well as of more self-awareness when verifying a given hypothesis on the basis of the cases mentioned above.

### Some points for investigation



## Structure

Methodology	Time spent (minutes)	Activity
GSE	20	1
Traditional	12	1

## Results



### Method of evaluation

Two groups of students, in their third year of high school have been taught the same topic about light. One group has studied the topic on the textbook using the traditional method; the other group has studied the same topic on the same textbook using the GSE method instead. For the evaluation was both groups of students have been given the same exercises and questions that are in their textbook.



Responses have been extremely positive with an increase of about 20% for each student. These data have helped me to consider the positive effects of spending a larger amount of time on the subject: since some activities for remedial courses were no longer needed (in reality the opposite quite frequently happens) ...



Light and shadows



Diffraction: the light through a curtain

	traditional method	GSE
Treatment and in-depth exploration of the subject	low	high
Developing Problem Solving skills	low	high
strong points		
	<ul style="list-style-type: none"> <li>autonomy in building your knowledge and a life</li> <li>ability to cooperate and interact with others</li> <li>ability to communicate orally on experiments</li> </ul>	<ul style="list-style-type: none"> <li>The students participate actively and constructively</li> <li>The students estimate discussions that enhance the creation and acquisition of ideas and concepts</li> <li>Self-learning is encouraged</li> <li>Contextualized application of knowledge is promoted</li> </ul>



From the inquiry to application  
1<sup>st</sup> Class - Course in Computer Science - Academic Year 2011/2012  
Students: P.Thiyagalagam, E. Ursino - Teacher: A. Pinizzotto

### The problem

The social, economic, and industrial developments in the 20th century were based upon the great availability of energy obtained by fossil resources. This had in effect low costs, abundant, stable materials and distribution. Today many things have changed. The massive use of this kind of resources has determined two greatest worrying results:

- A very fast climate changing due to the excessive emission of CO2 in the atmosphere.
- Their depletion and consequently the end of their economic convenience.

The scientific community is working on the solution of these matters on two **fronts**:

- The use of renewable resources (that are unlimited, distributed all over the world and with a low environmental impact).
- The improvement of energetic efficiency that in case of a building means obtain the same level of comfort with a reduced use of energy.

The experimental approach to the problem was very useful because allowed us to verify the manner in which the heat flows.

The use of measuring instruments interfaced with the computer has greatly improved and allowed us to construct the graphs in real time focusing on the phenomena and honor the calculations and formulas.

The topic has stimulated our curiosity and led us to **search** information and **research** on the web to make information about the problem.

Searching on the web we found that among transport industry and buildings, the greatest amount of energy is used by buildings and a large amount is wasted and dispersed in the environment.

### To conduct the research, We investigated in three directions

**To investigate if heat flows in both directions**

We have used some models of the house of equal size with the same floor area but of different materials. The heat source was a lamp of 60 Watts.

The temperature sensors placed inside the model allowed the record of temperature during heating, with a light lamp, and cooling, with the help of a fan. In the figure, the temperature has changed differently.

The **graphs** during the heating phase of the polystyrene model is like to a real residential opening of the model and this made us reflect on the importance of doors and windows that should have an airtight seal.

**To investigate the heat flow in both directions**

We used the model of polystyrene and two sensors placed on the wall opposite to the heat source.

The first measurement was made with the sensors at the same height.

The second measurement was made with the sensors at different heights.

**To identify the role of thermal mass**

The measurement was made by placing a light source of 600 Watts at the same distance from two walls of polystyrene and with a temperature sensor from the inside of each wall.

The experiences that we have conducted allowed us to discover that some materials can improve the isolation because they carry less heat. Thus can be used in the coating of buildings.

One of the ways to improve the energy class of a house is to use materials of construction and coating with low thermal conductivity.

The **data flows** business some simple and inexpensive solutions to reduce the heat losses towards the outside, with economic and environmental benefits.



# Documentazione del lavoro



 UNIVERSITÀ DEGLI STUDI DI PALERMO

## GRIAF

Gruppo di Ricerca sull'Insegnamento/Apprendimento della Fisica

People Projects Papers Experiments Materials

Digito la password



Main Page of the Project (<http://www.establish-9p.com/>)

Teacher Conference - Dublin 7<sup>th</sup>-9<sup>th</sup> June 2012



**EMC 2012**  
Science and Mathematics  
Education Conference

*Teaching at the heart of learning*

Dublin City University, Ireland  
7<sup>th</sup> - 9<sup>th</sup> June 2012

Poster 1 Poster 2 Poster 3 Poster 4 Poster 5

Workshops for Italian pre-service teachers

### PEDAGOGICAL MATERIALS

Teacher Guides	English Version	Italian Version
Classroom Materials	English Version	Italian Version
Tools	English Version	Italian Version

### WORK MATERIALS

Excel templates for student questionnaires

Lower secondary and for two years of upper secondary	Last three years of upper secondary
<a href="#">Italian school codes</a>	

# Documentazione del lavoro



I docenti che hanno partecipato alle attività di formazione e sperimentazione sono attualmente impegnati nella preparazione di articoli relativi ai propri risultati, da pubblicare sulla rivista

“Quaderni di Ricerca in Didattica” : [http://math.unipa.it/~grim/menu\\_quaderni.htm](http://math.unipa.it/~grim/menu_quaderni.htm)

## "Quaderni di Ricerca in Didattica"

(ISSN on-line 1592-4424)

How to prepare and submit an article for publication in  
Quaderni di Ricerca in Didattica/Science (QRDS)

**Editor in-Chief:** Claudio FAZIO (University of Palermo)

**Deputy Editor-in-Chief:**

Benedetto DI PAOLA (University of Palermo)

**Section B: "Quaderni di Ricerca in Didattica" QRDS (Science)**

**Editorial Director:**

Benedetto DI PAOLA (University of Palermo)

**Editorial board:**

Angelo BONURA (ITT Marco Polo, Palermo and AIF Palermo, Italy)

Matteo CAMMARATA (University of Palermo, Italy)

Michele Antonio FLORIANO (University of Palermo, Italy)

Marco GILBERTI (University of Milan, Italy)

Neil HUTTON (University of Sunderland, UK)

Marian KIREŠ (Univerzita Pavla Jozefa Šafárika v Košiciach, Slovak Republik)

Eilish MCLOUGHLIN (Dublin City University, Ireland)

Burkhard PRIEMER (Ruhr-Universität Bochum, Germany)









Alberto STEFANEL (University of Udine, Italy)

Giovanni TARANTINO (ANSAS and University of Palermo, Italy)

Italo TESTA (University of Naples, Italy)

Roberto ZINGALES (University of Palermo, Italy)

### Quaderni di Ricerca in Didattica/Science (QRDS) Index

2010 	Quaderno 1 Issue 1
2011 	Quaderno 2 Issue 2
2011 	Supplemento n.1 Issue 2.1
2011 	Supplemento n.2 Issue 2.2
2012 	Quaderno 3 Issue 3
2012 	Quaderno 4 Issue 4
2013 	Supplemento n.3 Issue 3.1
2013 	Quaderno 5 Issue 5



Printed Issue



Issue partially on-line



Issue published on-line

# Documentazione del lavoro



## **Articoli inerenti le attività di ESTABLISH pubblicati o inviati per la pubblicazione:**

O. R. Battaglia, C. Fazio, N. Pizzolato, “An investigation on the environment temperature variation in energy exchange by thermal radiation”, accettato per la pubblicazione su American Journal of Physics: (2013).

N. Pizzolato, C. Fazio, O. R. Battaglia, “Open Inquiry based learning experiences: a case study in the context of energy exchange by thermal radiation”, inviato per la pubblicazione a European Journal of Physics (2013).

N. Pizzolato, C. Fazio, R. M. Sperandeo Mineo, D. Persano Adorno, “Open-inquiry driven overcoming of epistemological and conceptual difficulties in undergraduate engineering students: a case study in the context of thermal science”, inviato per la pubblicazione a Physical Review Special Topics: Physics Education Research (2013).

Claudio Fazio, Giovanni Tarantino and Rosa Maria Sperandeo-Mineo, “Teachers’ competences about Inquiry Based approaches to the analysis of Thermal Phenomena: implications for an appropriate training”, Physics Alive, GIREP-EPEC 2011 International Conference . Jyvaskyla, Finlandia, 1-5 agosto 2011, ISBN: 978-951-39-4375-2

N. Pizzolato, O. R. Battaglia, R. M. Sperandeo Mineo, “An Inquiry Based Approach to the study of energy exchange by thermal radiation”, University of Jyvaskyla, Finnish Cultural Foundation. Physics Alive, GIREP-EPEC 2011 International Conference . Jyvaskyla, Finlandia, 1-5 agosto 2011, ISBN: 978-951-39-4375-2.

N. Pizzolato, O. R. Battaglia, C. Fazio, R. M. Sperandeo Mineo “Energy Exchange By Thermal Radiation: Hints and Suggestions for an Inquiry Based Lab Approach”. In: Twelfth International Symposium Frontiers of Fundamental Physics [FFP12], Udine, 21 Novembre 2011.

N. Pizzolato, C. Fazio, R. M. Sperandeo Mineo, D. Persano Adorno, “Open Inquiry investigations on heat transfer performed by undergraduate engineering students”, World Conference on Physics Education. Istanbul, 1-6 luglio 2012.

N. Pizzolato, C. Fazio, R. M. Sperandeo Mineo, D. Persano Adorno, “Open Inquiry based learning experiences to understand the Nature of Science”, ICPE-EPEC International Conference on Physics Education, 5-9 agosto 2013.

O. R. Battaglia, C. Fazio & R. M. Sperandeo Mineo, “An approach to the concept of statistical distribution: a pedagogical path based on Guided Inquiry”, ICPE-EPEC International Conference on Physics Education, 5-9 agosto 2013.