

Pensiero Computazionale e Insegnamento del Coding

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LOGIC
PREDICTING
&
ANALYSING

THE
COMPUTATIONAL
THINKER:
CONCEPTS AND
APPROACHES

TINKERING
EXPERIMENTING
&
PLAYING



CONCEPTS



Un Movimento Mondiale



| Partecipa | Costruiamo Insieme | Pensiero computazionale |

PENSIERO COMPUTAZIONALE E CODING - PROPOSTE

OBIETTIVO

Preparare una prima roadmap per l'educazione al pensiero computazionale e al coding nella scuola italiana.

COORDINATO DA

Segreteria Tecnica, MIUR | pensierocomputazionale@miur.it

AUTENTICATI PER INSERIRE UNA NUOVA PROPOSTA



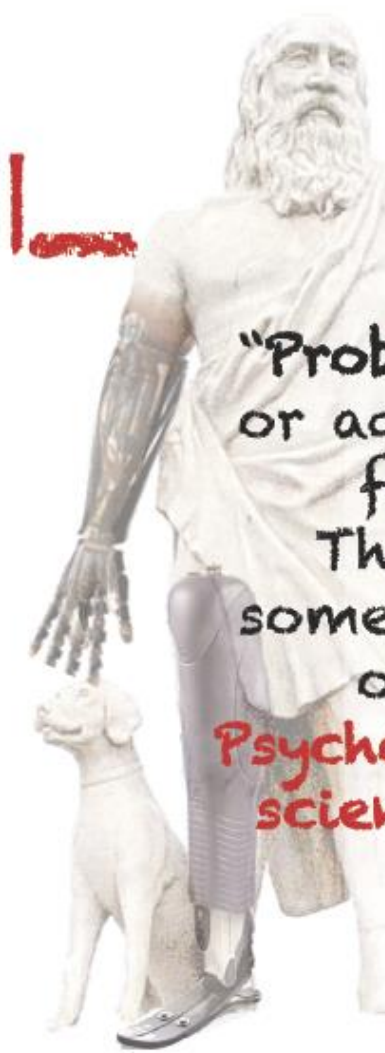
I Termini del Problema



steps focused tracing moving something problems thinking testing engineering through contain strategies researchers simple action study cause skills product relation
Problem Solving
(Wikipedia)
steps process initiated describes
work solve novel difficulty analyzed
assessing approaches logic psychologists
large cognitive inside typical human field actual
used research trace human existing skills goal past
best try solution system attempts
motivational possible control psychology relation transition solution
useful experimental system relatively condition tradition solution
goals life skill similar disrupt solutions difficult theoretical
target techniques main expertise access process description defined

"Problem solving consists of using generic or ad hoc methods, in an orderly manner, for finding solutions to problems. The term is used in many disciplines, sometimes with different perspectives, and often with different terminologies.

Psychology - Cognitive sciences - **Computer science** - Engineering - **Military science**".



Computational Thinking [Wing, CACM 2006]

“the capacity to undertake a **problem-solving process** in **various disciplines** using distinctive techniques that are typical of computer science. Typical CT techniques usually refer to:

- representing information through **abstractions** such as **models** and **simulations**;
- **automating solutions** through algorithmic thinking”.

ABSTRACTION
removing
unnecessary
details

SPOTTING & USING
SIMILARITIES

Persevering
keeping going

CONCEPTS

APPROACHES



JUDI DE



Coding

"Computer programming is a process that leads from an original formulation of a computing problem to **executable computer programs**. Programming involves **analysis**, developing understanding, **generating algorithms**, verification, and **implementation in a target programming language (coding)**."



Dal Punto di Vista
Didattico...



Le Relazioni

Problem Solving

instance of

Computational Thinking

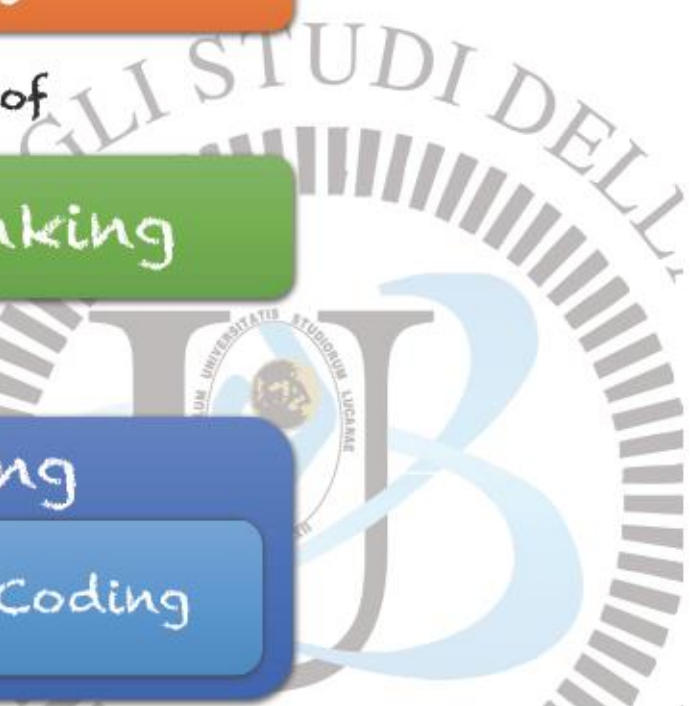
enables

Computer Programming

Modeling

Algorithmic Thinking

Coding



Metodi Didattici

Computer Programming

Approccio
"Carta e Penna"

Modeling

Algorithmic
Thinking

Coding

Approccio
"Hands-on"

Metodo Deduttivo

Metodo Induttivo



IL Flusso del CT

Ambito Disciplinare

Problema

Modello

Implementazione e
Simulazione

Decisione

Apprendimento

Es: Biologia

Es: Genetica Mendeliana

Es: Crossover, Probabilità

Es: Analisi delle piante

Es: Quesiti sul genotipo



IL FLUSSO del CT

Ambito Disciplinare

Problema

Modello

Implementazione e
Simulazione

Decisione

Apprendimento

Es: Lingua straniera

Es: Analisi del testo

Es: Frequenza dei termini

Es: Analisi statistica di
un testo dato in due lingue

Es: Ricchezza del linguaggio





Casi di Successo e Rischi



Insegnare La Programmazione

E' Complesso

Astrazione e
"Scatola Nera"

"A survey of literature on the teaching of
introductory programming"

Arnold Pears Uppsala Uni., Sweden

Stephen Seidman Uni. of Central Arkansas

Lauri Malmi Helsinki Uni. of Tech., Finland

Linda Mannila Åbo Akademi Uni., Finland

Elizabeth Adams James Madison Uni.

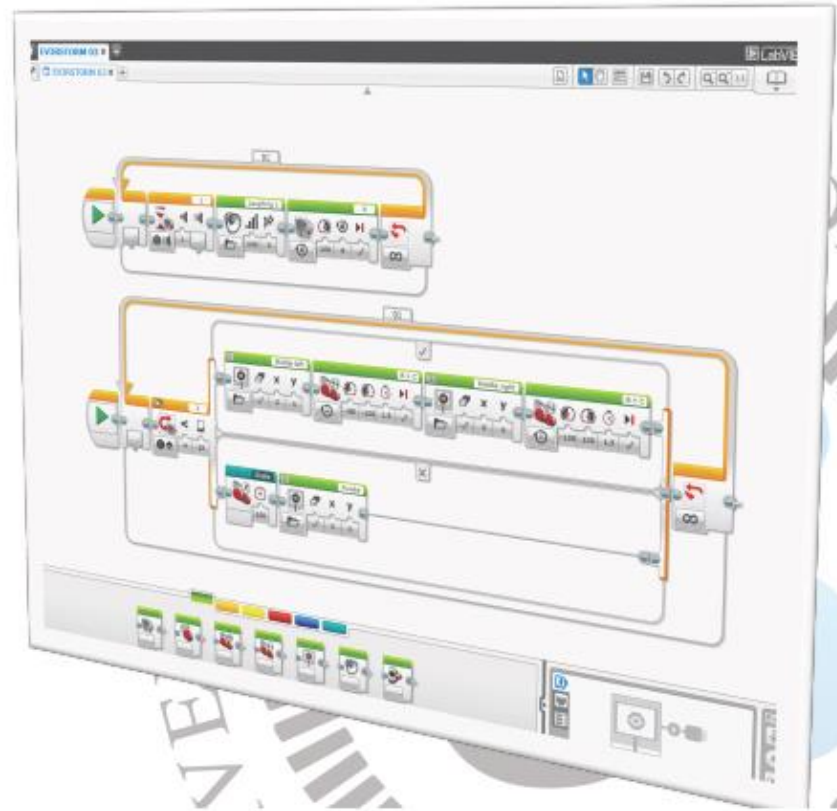
Jens Bennedsen IT Uni. West, Denmark

Marie Devlin Newcastle Uni., UK

James Paterson Glasgow Caledonian Uni., UK

Proceeding ITICSE-WGR 2007

Robotica Educativa





Microworlds [Moons 2013]

C O
D E

Puzzle 20 I've finished my Hour of Code



▶ Run Program

Blocks

- move forward
- turn left \downarrow
- turn right \downarrow
- repeat until 
- do
- if path ahead \downarrow
- do
- else

Turtle

- clean
- forward
- back
- left
- right
- high
- low
- penup
- pendown
- setxy
- seth
- say
- sayfor
- saytime
- saycolor
- sayfillcolor
- saystrokecolor
- saystrokewidth
- sayfont
- sayfontSize
- sayfontWeight
- sayfontStyle
- sayfontColor
- sayfontColor2
- sayfontColor3
- sayfontColor4
- sayfontColor5
- sayfontColor6
- sayfontColor7
- sayfontColor8
- sayfontColor9
- sayfontColor10
- sayfontColor11
- sayfontColor12
- sayfontColor13
- sayfontColor14
- sayfontColor15
- sayfontColor16
- sayfontColor17
- sayfontColor18
- sayfontColor19
- sayfontColor20

Visualizzazione

The screenshot displays the JELIOT IDE interface. On the left, the source code for a Java program is visible, including classes Polygon, Rectangle, and Square. The main method in MyClass attempts to access an array element at index 4. The central area shows the execution state, including a stack frame for TestExceptions.main and a variable view for an array of integers. The array contains values [0, 1, 2, 3] at indices 0 through 3, and the value 4 is shown at index 4. A red box highlights the exception handling logic in the code, and a red arrow points from the exception object in the variable view to the corresponding code block. On the right, a red-bordered window titled 'ArrayIndexOutOfBoundsException 333' provides a detailed explanation of the error, including the line of code that caused it and a link to 'More information'.

```
1 import javax.io.*;
2
3 public class Polygon {
4     int sides;
5     Polygon(){}
6     Polygon(int s){
7         sides=s;
8     }
9 }
10
11 public class Rectangle extends Polygon{
12     int width,height;
13     Rectangle(){
14         super(4);
15         width=0;
16         height=0;
17     }
18     Rectangle(int w, int h){
19         super(4);
20         width=w;
21         height=h;
22     }
23     public int getArea(){
24         return width*height;
25     }
26 }
27 public class Square extends Rectangle{
28     Square(){
29     }
30     Square(int s){
31         super(s,s);
32     }
33 }
34
35 public class MyClass {
36     public static void main( |
37         Square square;
```

```
public static void main (frame 1)
{
    int[] numbers = {3,3,0};
    int i = 4;
    12 public static void main(String[] args) {
    13     int[] numbers = new int[4];
    14     for(int i=0;i<=numbers.length;i++){
    15         numbers[i]=i;
    16     }
    17 }
}
```

int[] 330

int length	4
0 int	0
1 int	1
2 int	2
3 int	3

ArrayIndexOutOfBoundsException 333

The program generated a **ArrayIndexOutOfBoundsException**

The arrow points toward the line in which the exception occurred:

```
numbers[i]=i;
```

In this line, the index the program uses to access the slot in the array has the value of "4". This slot does not exist in the array.

Most often, the **ArrayIndexOutOfBoundsException** exception is generated when the program tries to access a slot in an array (through the index) that does not exist. This happens for example when the counter in a loop, which is used as an array index in the body of the loop, is incremented beyond the number of slots in the array. Remember, in Java the array index starts at zero, not at one. The first line in the following list will produce this exception, the next will not.

More information:

[?](#) [?](#) [?](#)

Fig. 7. This example shows the presentation of exception objects in the visualization, and the integration with on-line resources to explain the actual exception. In this example, the student tried to access index '4' in an array which only has indexes '0' to '3'.

I Limiti del Visual Coding...





Azioni per il Distretto Scolastico 2.0



Programmazione a oggetti
in linguaggio Java con
metodo

ACME

Proposta nata nell'ambito del progetto
"Distretto Computazionale Lucano"

promosso da Distretto Scolastico 2.0, USR Basilicata e UniBas



La Visione

Progetto strategico di rilevanza regionale

Metodologia unificata per primaria e secondaria

Sviluppo di strumenti per l'insegnamento
del coding e il CT nelle scuole secondarie

*** Formazione degli insegnanti ***

Sperimentazione e internazionalizzazione



Grazie per
L'Attenzione

