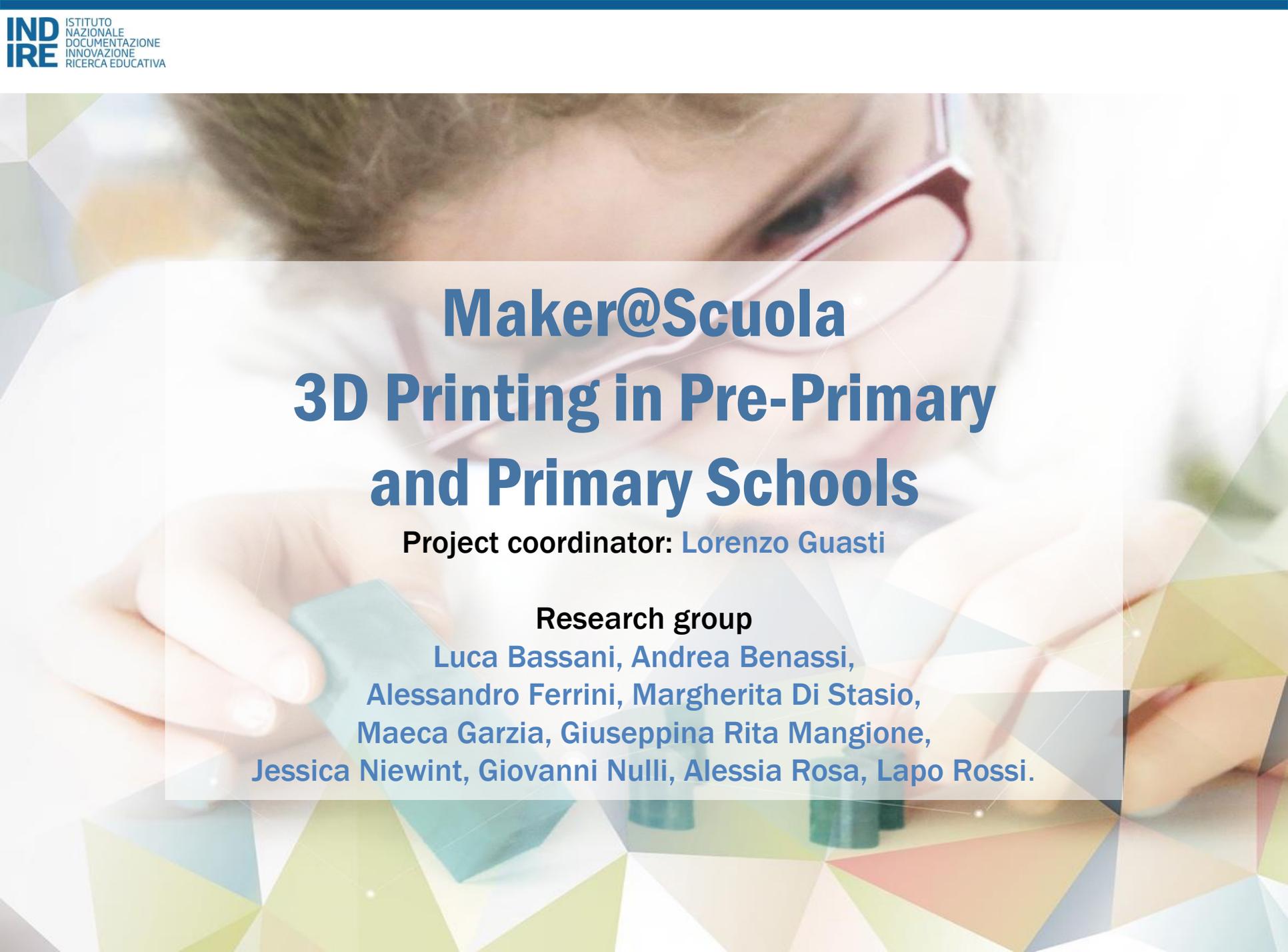


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# **Maker@Scuola**

## **3D Printing in Pre-Primary and Primary Schools**

**Project coordinator:** [Lorenzo Guasti](#)

### **Research group**

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Alessandro Ferrini, Margherita Di Stasio,  
Maeca Garzia, Giuseppina Rita Mangione,  
Jessica Niewint, Giovanni Nulli, Alessia Rosa, Lapo Rossi.**

# Maker Pedagogy at school

Which **processes** can they support?  
Through which **WORK CYCLE?**



Makification

School

Childhood

# Maker Pedagogy at school

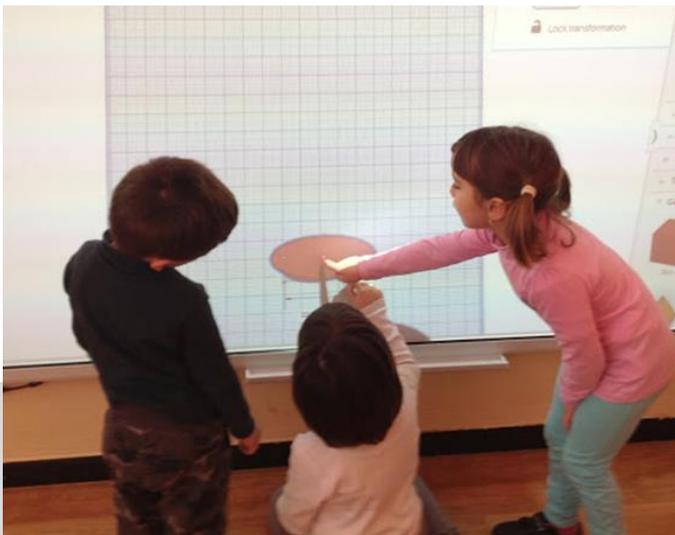
**persistence during a challenge**



**customization**



**peer feedback**



**failure = opportunity for improvement**



# Think Make Improve and 3D Printing at school

- **Think:** *problem setting* phase. For 3D printing assignments, students decide – among themselves and with the teacher – what they will realize. They make the task verbal bringing out any lexical difficulties, and exploring the issue through drawings or other materials.
- **Make:** a phase during which all *creation* and *student mediation processes* occur concerning the objects to be realized. In the case of 3D printing assignments, this is the moment when the model is designed and printed.
- **Improve:** *test phase* to check if the model works, or if it is compliant with the characteristics designed during the thinking phase and realized in the make phase. For 3D printing assignments, there is a verification on the object's characteristics, the approval by the group, or the transition to a new think phase. In this context, a failure is not seen as something negative, but as an opportunity to improve and enhance the project..

# State of the art

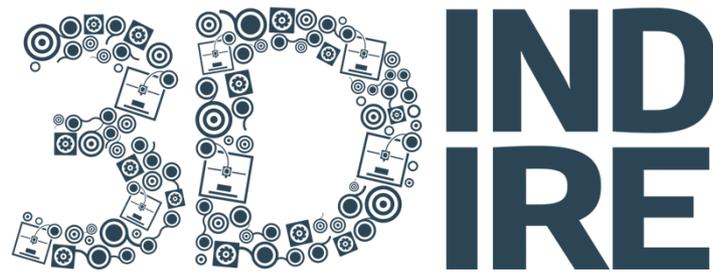


# The **Research Questions** for the **Pre-Primary School**

An **educational path focused on the 3D printer** in a playful context, working with 5 year old children, promotes the development of:

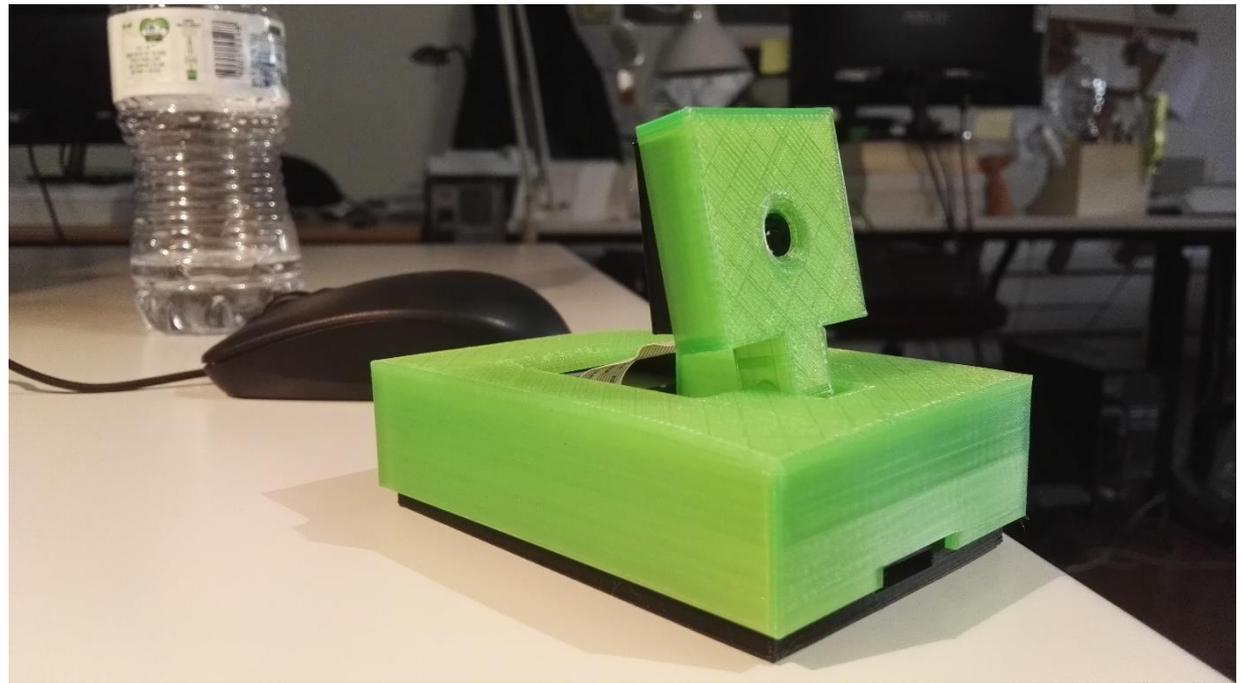
- **Awareness of the task**
- **Logical thinking**
- Foresight capacity for **abstraction**
- **Lateralization skills**
- Ability to **verbalization** of the strategies
- **Metacognitive skills**

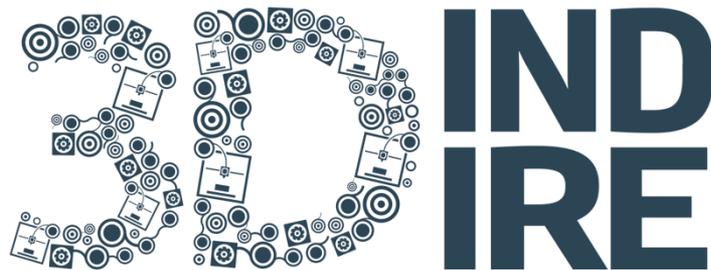
**GOAL:** Identification of the potential use of 3D printing in the kindergarten as a part of educational pathways for the development of skills



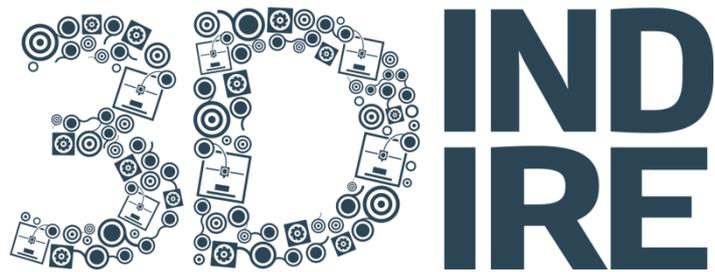
**in3Dire** is an open source software system and open hardware-based **Raspberry Pi** to make the design of the pieces to be printed independently by internet and paid software to facilitate work at the schools.

It also is a complete system to manage a private wifi network in class with several services active for the teacher and the students

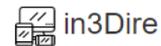




Raspberry Pi3

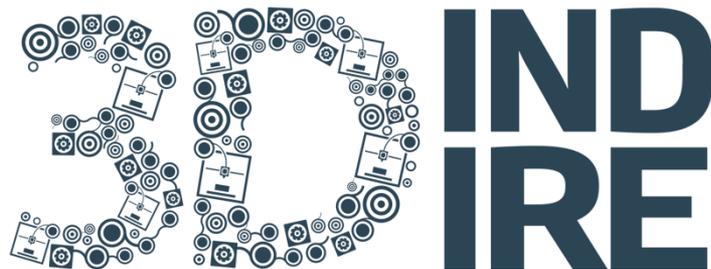


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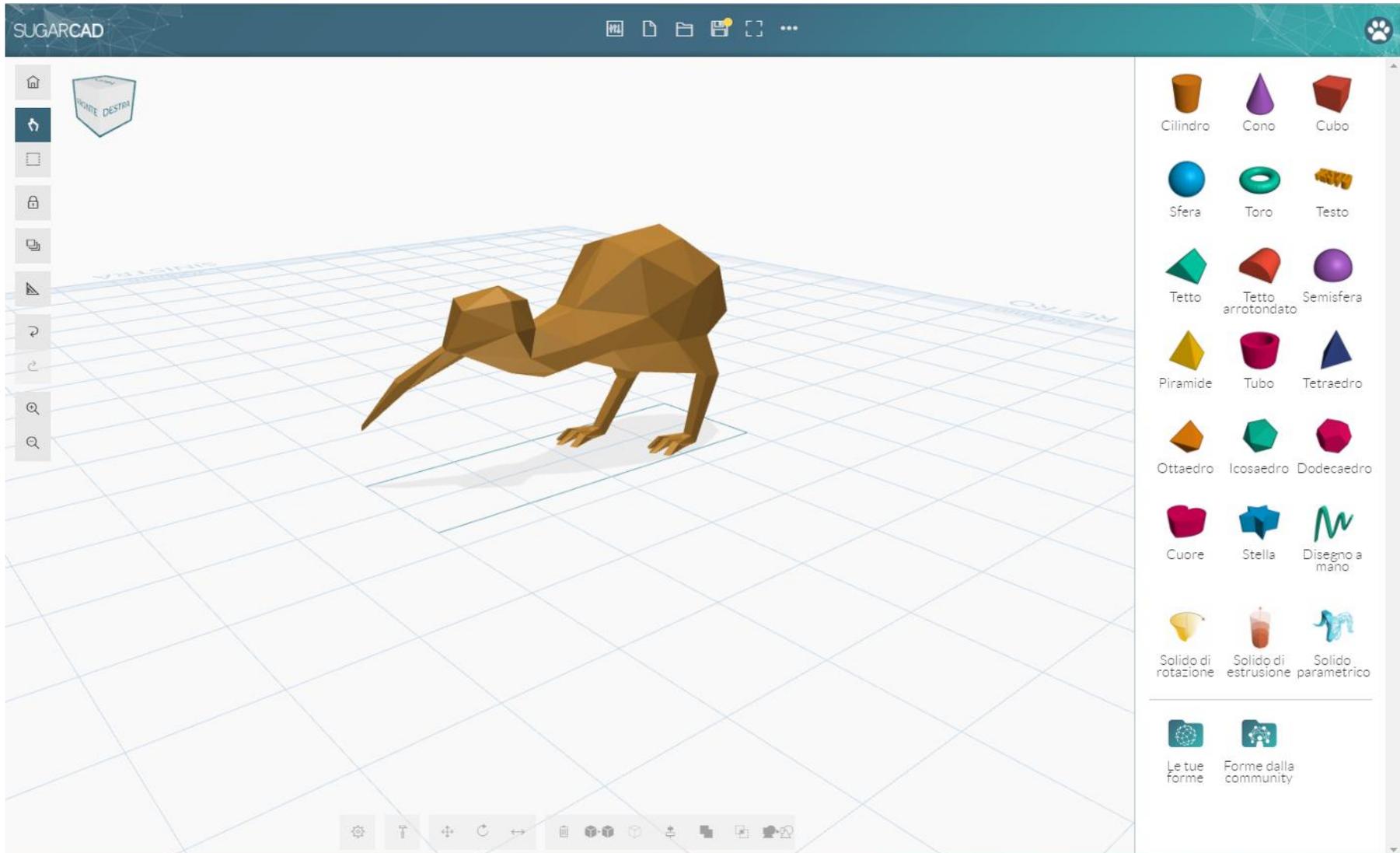
in3Dire è un server basato su schede SBC (Single Board Computer) che, tramite l'erogazione di una rete Wi-Fi privata, mette a disposizione un insieme di servizi web dedicati alla modellazione e alla stampa 3D.

 <b>OwnCloud</b> Condivisione	 <b>SugarCad</b> Disegno	 <b>Octoprint</b> Gestione stampe 3D	 <b>Diario</b> Documentazione
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**The services provided are optimized for 3D printing, but include functionality designed to optimize classroom activities, such as assignment and delivery of tasks, sharing of materials, and writing a collective blog**

# SugarCAD



# **SugarCAD**

**SugarCAD has been developed entirely at Indire**

**Teachers and students can design their own shapes and projects using the SugarCAD software directly from their web browser.**

**SugarCAD provides basic and complex functionalities, depending on the user's level, and permits to export the generated shapes in the STL format, which is the standard 3d printing file format.**

**SugarCAD is designed to be, as best as possible, intuitive and user friendly.**

# SugarCAD

The screenshot displays the SugarCAD web interface. On the left is a vertical toolbar with icons for home, back, forward, and search. The main content area is titled "Forme dalla community" and features a search bar with the text "Scrivi per cercare nel nome o nei tags della forma". Below the search bar are three model cards:

- Klein**: A purple Klein bottle. Author: Alessandro Ferrini. Tags: klein. Creation date: 30/05/2017 alle 15:36. Last modification: 21/07/2017 alle 12:42. Includes a green button "LEGGI IL CODICE SORGENTE" and a blue "INSERISCI" button.
- Vite**: A grey screw. Author: Alessandro Ferrini. Tags: vite, screw. Creation date: 13/06/2017 alle 11:10. Last modification: 12/07/2017 alle 09:43. Includes a green button "LEGGI IL CODICE SORGENTE" and a blue "INSERISCI" button.
- Balena**: A purple whale. Author: Alessandro Ferrini. Tags: balena, whale. Creation date: 12/07/2017 alle 08:52. Last modification: 12/07/2017 alle 08:55. Includes a blue "INSERISCI" button.

On the right side of the interface is a sidebar with a grid of 3D primitive shapes, each with a label: Cilindro, Cono, Cubo, Sfera, Toro, Testo, Tetto, Tetto arrotondato, Semisfera, Piramide, Tubo, Tetraedro, Ottaedro, Icosaedro, Dodecaedro, Cuore, Stella, Disegno a mano, Solido di rotazione, Solido di estrusione, Solido parametrico. At the bottom of the sidebar are two folder icons: "Le tue forme" and "Forme dalla community".



## Real problems: **Connection**

**In order to work using Online 3D Model Software, access to the internet is crucial. A lot of schools offer a WIFI network linked to the local town network. Often times however this kind of connection is weak, and is subject to restrictions, limiting browsing and navigation, making it not the best choice.**

## Real problems: **Browser on the LIM**

**The use of Tinkercad with the browser via the Active Board needs special specifications: not all browsers handle the touch in the same way, the JavaScript offers its events called "TouchEvent" which are managed by variables that are not equal for all browsers. Our experience suggest to use Firefox, with everything update.**

