WHAT WEEE ARE

- Pilot Project -

PRESENTATION

During the last decade, natural resources have been thinning while extraction technologies have grown more complex and expensive. Metals, precious metals in particular, are at the base of the economy and are necessary in the production of most of our commodities, from cars to ICT, from medicine to art.
Waste Electric and Electronic Equipment (WEEE) yields higher percentages of precious metals compared to remaining natural deposits. However, separating such complex materials, which are fully assembled and capillary-distributed around the planet, poses challenging logistic, technological, social as well as environmental issues.
Among other issues, which have emerged during the COBALT dialogue held in Brussels on June 6th and in Copenhagen on October 8th, 2014 (www.cobalt-fp7.eu), information and education were highlighted as key players. It is therefore necessary for new generations to open up to a wider vision of technology, not only as means of communication, but for true material value of Electric and Electronic Equipment (EEE). Thus, understanding where things come from and where they will go and discovering different aspects of the economic cycle, from production to urban mining and consumer awareness, is fundamental.

General Objectives

The project objective is to implement a cycle of interactive workshops in high schools. The meetings will offer an overall view on the origins of materials, a few notions on physical and chemical characteristics and what happens after disposal.
There will be an interactive class assignment in which students will dismantle a technological product (e.g. phone, toy, pc) highlighting through group analysis the various issues concerning collection, disassembly, refurbishing as well as recovery of materials.
Finally the class, divided into smaller groups, will create some designs specifically addressing one of these topics: production, consumption and recycling.

Target Group

One class of the Liceo Artistico “A. Passoni”- diploma in Industrial Design (www.lapassoni.it)

Instructors

Alessio De Marchi, expert in waste electronics and green design held the meetings.
The presence of the teacher was recommended.

Cost

As pilot project, participation was free.
Cost evaluation for future implementation: EUR 900 per Module (3 two-hour lessons)

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RESEARCH

This section explains in detail the methodologies used during the three encounters and the topics analyzed in class. The approach was subdividedinto three focus areas: 1-Theory, 2-Disassembly and 3-Design, aimed at raising students'awareness over the use of raw materials throughout the value chain and in our daily lives.

Methodologies

The workshop was organized in 3 two-hour meetings focusing respectively on theory, dismantling and design.
The pilot project was proposed in one class of the Liceo Artistico “A. Passoni”.
The students of class 3D, in their third year, have just chosen to specialize in Industrial Design.
Age 16.

1 – Theory

The first meeting was a frontal lesson on metals. An array of topics ranging from a brief introduction on physical, chemical and mechanical properties of materials in general to the specific characteristics and importance of precious metals were covered. The following lesson focused on mineral extraction methods, from traditional mining to bio mining and the new perspectives offered by urban mining and space mining.
The main theme emphasized the importance of raw materials such as Precious Metals, Conflict Minerals and Rare Earth Elements, highlighting the important role they cover in our daily lives. Efforts were made to bring a holistic approach to the subject specifically addressing the critical issues arising throughout the entire value chain from extraction to production to consumption and the role of consumers.

2 – Disassembly

The second part involved hands-on activity. The students were provided with gloves, masks and some common hand tools (screwdrivers and pliers). They were asked to disassemble some random pieces of Waste Electronic Equipment as fast as possible, precisely separating the different materials. Then they had to complete a report recording weight and type of waste retrieved. The students were then encouraged to form discussion groups on the arising issues concerning raw materials. This raised discussion about design, dismantling and waste management of Electronic Equipment in particular.

3 – Design

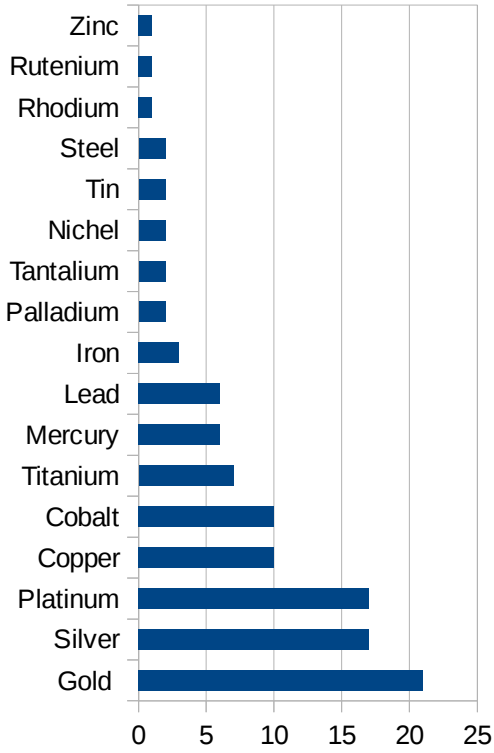
The third part was dedicated to creativity. The students were asked to design the world as they imagine it, taking into consideration the issues discussed in the previous meetings. In closure the students filled in a final evaluation questionnaire regarding their degree of interest and satisfaction.

RESULTS

This section analyzes the results of the research work done in class, highlighting aspects of general knowledge and consumer awareness, focusing on how design can influence and improve to reduce the impact of human activities.
Following the research objectives, also this part was divided into three sections (1-Theory, 2-Disassembly and 3-Design) focusing on the respective target issues.

1 – Theory

Prior to beginning the workshop, the students were asked to complete a questionnaire in order to assess their level of general awareness, ranging from basic notions on raw materials to specific information regarding Waste Electric and Electronic Equipment. There were 23 class members in total.21 recognized Gold as a precious metal, followed directly by 17 who recognized Silver and Platinum as precious.. Nevertheless, other Platinum Group Metals were not considered to be particularly valuable. Unexpected interest was shown for Cobalt.



More than 82% of the class knew that precious metals are valuable for their properties and because they are rare, while few considered beauty and optical properties to be particularly characterizing.

95% of the class knew that metals come from mining operations, while none considered waste streams to be a potential source of raw materials. However, over 50% of the participants were aware that the WEEE acronym (in Italian RAEE) indicates a special typology of waste; five students (20%) did not answer this question.

22 students out of 23 have a computer and six (26%) declare to possess more than one in their household. Despite all class members have cell phones only 34% are aware that their devices contain a portion of nearly all the elements of the planet.

More than half of the participants currently store WEEE in their households, while only 3 have donated their obsolete devices to be reused by others. Unfortunately over 25% admit having disposed of their Waste Electronics throwing them in regular trash bins. Only 1 out of 23 (4%) was aware of the free Municipal door-to-door WEEE collection service.

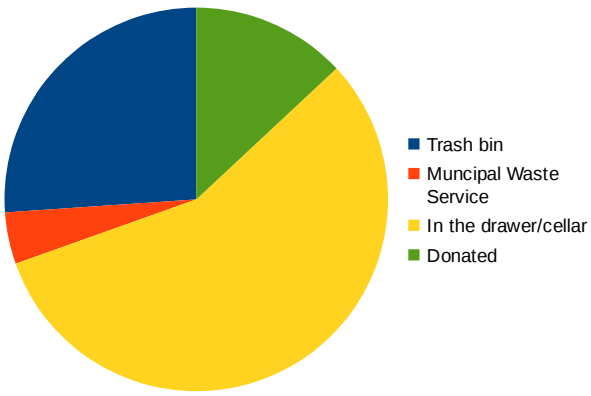
Over 70% of the participants highly appreciated the workshop and would suggest it to others and more than half the students declared having learned something new. Probably because the art school attracts hands-on kind of people more than half the class (52%) had fun dismantling the Waste Electronics and discovering the variety of materials inside. More than one sixth of the participants felt the workshop brought them to have a broader perspective on global issues concerning raw materials and their role in the design industry and our daily lives. However, they felt uncomfortable to be held partly responsible for current global issues concerning raw materials.

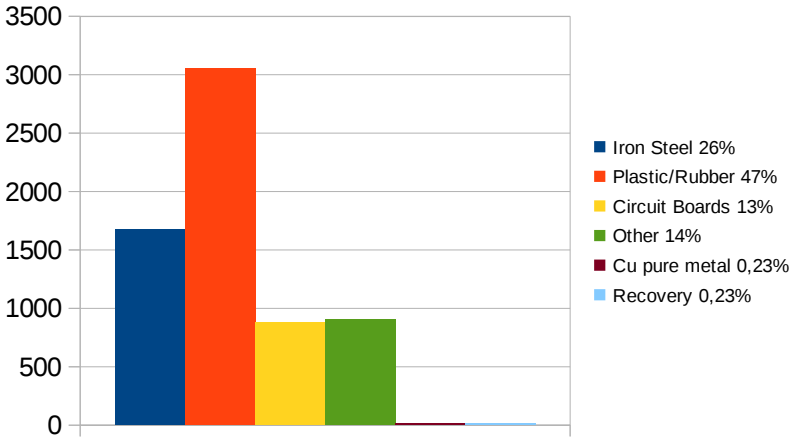
It was interesting to notice that the people who had less notions regarding precious metals and were not aware of the meaning of the acronym WEEE (RAEE in Italian) were the same ones who declared having disposed of their obsolete equipment in regular trash bins. Therefore, it is plausible that raising awareness over the issues regarding raw materials could induce consumers to better dispose their Waste Electric and Electronic Equipment, or convince them to store it a home until they have a chance to dispose of it correctly.

2 – Disassembly

The students were provided with masks and protective wear and common hand tools such as screw drivers, pliers and hammers, to conduct the dismantling operations. The instructor brought to class 5 objects retrieved in trash bins: 1 TV Antenna, 1 Video game, 1 Floppy A: Drive, 1 Printer and a professional photocopy machine Server, while only one student brought two cell phones.

The students were then asked to dismantle and separate the materials as quickly as possible and differentiate them as best they could.





The items were dated from 1988 (video game) to 2004 (printer) and totaled a weight of 6.450 grams of which 878grams was circuit boards and 1.6kg of ferromagnetic structure metal while plastics accounted for the majority.

Time employed for the dismantling operation varied from 15min. for the video game to 47min. required for the dismantling of the desktop printer with an average of 26min. per item.
The great majority of materials separated were plastics (avg. 47%), followed by 26% of Iron and ferromagnetic metals. Circuit boards only counted for an average 13% of materials recovered and a mere 0.46% was either pure metal (such as copper wiring) or reusable parts (i.e. 4GB Memory Card). Other materials, mainly glass, were found to represent an average 14%.

Comments forwarded by the students regarding their experience in the disassembly operations mainly addressed the number and different types of screws found, click joints, use of glues, grease and ink and the quantity and variety of different materials found.

3 – Design
During the last meeting the students were asked to re-elaborate the information acquired during the first two sessions. The main objective for the students of the design course was to create designs on three different topics:

a) Production in the sense of conceiving new product designs aiming at resolving the problems observed during the dismantling phase taking into consideration the specific issues regarding responsible use of raw materials and precious metals in particular.
The designs produced were mostly focusing on dismantling operations such as number and type of screws and upgradeable features.

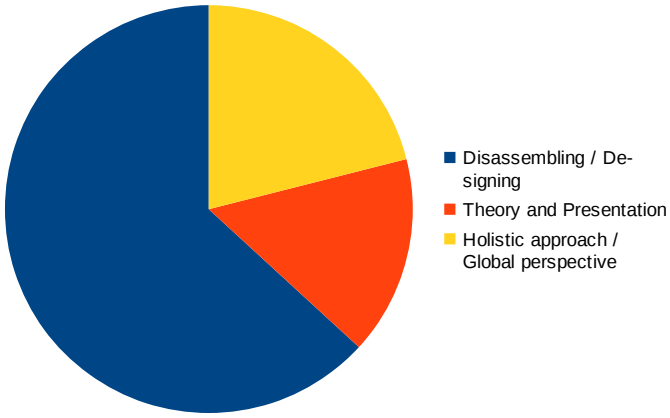
b) Consumer Awareness.). Other ideas aimed at a different approach to consumption in general (custom glass bottles that can be ordered on the Internet and refilled with all sorts of beverages and liquids at the local shop). Other students designed a roller-coaster-bus to go to school in the morning

c) Recycling - The students choosing to address this topic were the majority and the designs focused on stimulating sound disposal of Waste. All the designs aimed at making disposal of waste a more exciting experience (for example a fruit machine that takes compressed cans instead of coins).
Since a notable 83% of the students declared to enjoy their phone because of the Apps, some students brought up the idea of creating a WEEE recycling App in which different items must be dismantled as fast as possible and correctly separated in order to earn points. The best scores could then be shared on social networks winning virtual prizes and upgrades for the quantities of WEEE correctly recycled and dismantled.

Conclusions
19 out of 23 students really appreciated the workshop and 17 would recommend it to others.

60% thought they learned something new while 75% found the workshop subjects interesting and would place them at 7.5 on a scale 1 min-10 max.

Lesson content and delivery as well as the activities were highly appreciated averaging 8.3 on a 1min-10 max scale.



5 participants preferred the theory involving basic information on metals, precious metals, mining and technology, furthering into concepts regarding conflict minerals and sustainable and responsible use of raw materials.

52% really enjoyed the dismantling activity and learning how electric and electronic devices are made on the inside, and all were stunned by the amounts and variety of materials employed. Many observed how complex and hard to separate certain materials and objects are compared to others. Interestingly , 17% were captured by the holistic approach and the global perspective on issues involving raw materials in general and in particular by the involvements of technological development on world and natural equilibriums. One student was struck by the ambition of changing the world and felt empowered as a human being to act to improve things.