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Sustainable Housing

2020-2021

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1. The research topic: Sustainable housing

Building sustainable facilities has become a more and more discussed issue.

- How would you define a sustainable facility?
- In which proportion do you consider your home or school building sustainable?
- If you were part of a team of architects, how would you design a sustainable building?

2. Introduction

By dictionary, sustainability is the quality of causing little or no damage to the environment and therefore the quality of being able to continue for a long time. Through our research we tried to define sustainable housing and discover the aspects which make a building environmentally sustainable. We designed our own house idea and created a game in order to teach our school mates more about this topic. To find out whether our school building was sustainable, we asked the students to take a survey. In the following pages we are going to present our work and the conclusions we have come to.

3. Research work

3.1. What is sustainable housing?

Sustainable housing is one that makes efficient use of resources and energy with minimal impacts on the environment. It promotes a better quality of life and involves less waste, better reliability, lower life-cycle environmental impacts, less maintenance, and more reuse. What we build matters and so does how we build it.

3.2. What makes a house environmentally sustainable?

There are many improvements that can be done to make your home more sustainable and here are some of them:

- **Insulate walls, ceiling and underfloor** to aid heating and save on energy costs.
- **Install double-glazed windows or thermal-backed curtains** if double glazing is too expensive.
- **Utilise the sun.** Orientate the house for maximum sunshine, install solar water-heating and consider passive heating options.

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- Select **appliances with high energy-efficiency ratings**. Swap regular light bulbs for **eco bulbs**. Design for maximum natural light to reduce artificial lighting.
- Choose **non-toxic building materials**. Source materials locally, to reduce the environmental impact of transporting them.
- Install a **rainwater collection tank**. Choose **water-efficient appliances** and **low-flow sanitary fittings**.
- **Minimise waste and recycle** where possible, especially when demolishing and building.
- Use **renewable electricity** sources where possible by generating onsite or by choosing a power company that generates from renewable sources.
- Choose native and local plantlife for gardens and landscaping.

3.3. Our house idea



Image 1 – Design of a sustainable house

We have worked on a house design which meets all the aforementioned criteria. We used www.planner5d.com, an online application, to create the design.

We envisioned a house which is both comfortable and environmentally friendly, a house you can grow old in. The materials we have in our minds to use for building the house are either sustainable, recycled or renewable resources.

To fit in with the parameters of a sustainable construction, each floor of the house is around 2.8 meters tall. The design includes large, double-glazed windows, which provide lots of natural light. When natural light is not enough, LED lights come in handy. Proper insulation and underfloor heating, ensure that the temperature is just right at all times. Electricity is provided by the solar panels installed on the rooftop. The surroundings of the house consist of lots of greenery. There is also an outdoor terrace on the first floor, where you can relax and spend time in the sun.

Floor planning:

1. Ground floor:

As you can see in the following picture, the ground floor includes a nice sized garage, a storage room, a nice open space living room and kitchen, as well as a guest bedroom and bathroom.



Image 2 – Ground floor plan

2. First floor:

The first floor includes two bedrooms, bathroom and an office room/playroom (depending on what you prefer).



Image 3 – First floor plan

As it can be seen, what makes the house sustainable is not necessarily the building itself, but the materials used, the appliances, the heating system etc. To sum it all up, all the small details contribute to what makes the house sustainable.

3.4. What materials should be used to build sustainably?

It is best to use local materials, as they do not require transportation. To ensure low energy consumption, materials that insulate effectively are a must. Also, everybody wants a house that lasts, so using durable materials is very important.

Some of these materials are:

Grasscrete: a method of laying grass and concrete to create sidewalks, flooring, pathways in such a manner that there are open spaces between pieces of concrete which allows grass or other flora to grow in between them. Beside using less concrete, this method also provides faster draining when it comes to rainwater.



Image 4 – Grasscrete

(<https://www.solaripedia.com/images/medium/7068.jpg>)

Straw Bales: used as a means of insulations, but also for structure, replacing other materials such as concrete, wood, gypsum, plaster, fiberglass, or stone. When properly sealed, these straw bales naturally provide high levels of insulation for both hot and cold climates and are not only affordable but also sustainable as straw is a rapidly renewable material.



Image 5 – House insulated with Straw Bales

(https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcTkZJ5z0JXmA4dxAo_zb7_XrKXN9D1Z_fg2SGg&usqp=CAU)

Recycled plastic: Instead of mixing, extracting, and milling new materials, researchers are creating concrete that includes recycled plastic and trash, which not only reduces greenhouse gas emissions, but reduces the weight of the building and landfill-clogging plastic waste.



Image 6 – Recycled plastic bricks

(<http://rozenbergquarterly.com/wp-content/uploads/2016/08/Building.jpg>)

3.5. Is our school building sustainable?

Our school, Colegiul Național “Emil Racoviță”, is located in a historical building, over 100 years old, in the heart of Cluj-Napoca, Romania. Considering how old the building is, is it sustainable? To find out the answer, we have asked the students to take a short survey.

Out of approximately 360 high school students in our school, 139 have taken the survey.

The survey focuses on four main aspects: water consumption, electricity consumption, room measurements, insulation.



Image 7 – Colegiul Național “Emil Racoviță”
(https://upload.wikimedia.org/wikipedia/commons/0/09/Kolozsvar_Emil_Racovita_Liceum.JPG)

3.5.1. Water consumption

The following chart shows in which proportion, the students agree with the fact that our school uses a lot of water. They were asked to assess this statement on a scale from 1 to 4, where 1 means total disagreement and 4, total agreement.

Around 7% completely disagree, approximately 50% disagree, while 40% agree, and the rest 6% completely agree.

Our school uses a lot of water.
139 responses

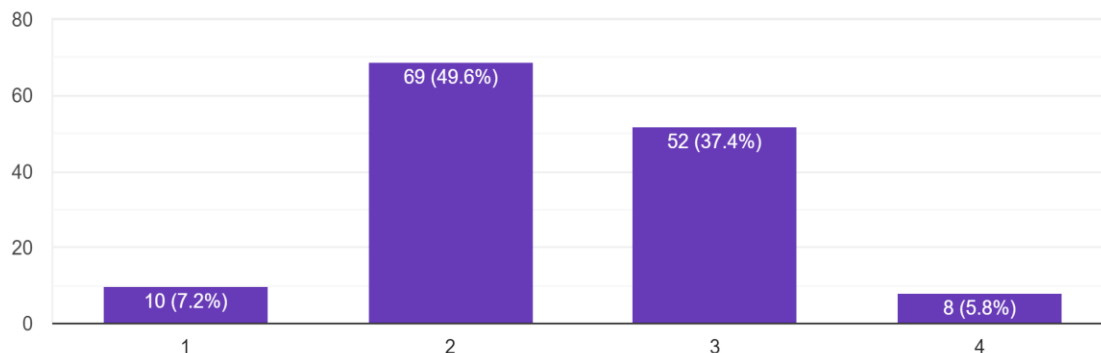


Image 8 – Water consumption chart

3.5.2. Electricity consumption

The students were asked to assess electricity usage, on a scale from 1 to 4, where 1 equals very little and 4 means very much.

Observing the following chart, which sums up all answers, we can see that around 60% of the students believe that our school uses a moderate to high amount of electricity.

How much electricity do you think our school uses?

139 responses

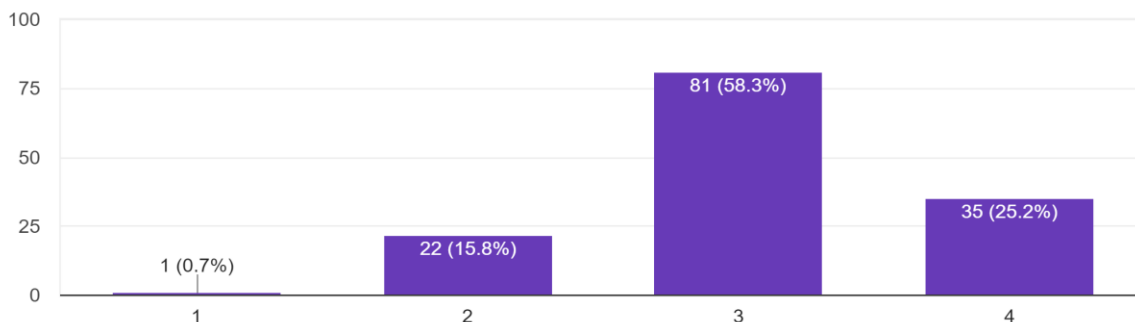


Image 9 – Electricity consumption chart

3.5.3. Room measurements

For a building to be considered sustainable, each floor needs to be 2.80 meters tall and the top floor needs to be 2.60 meters tall.

Do you think our school meets these standards?

138 responses

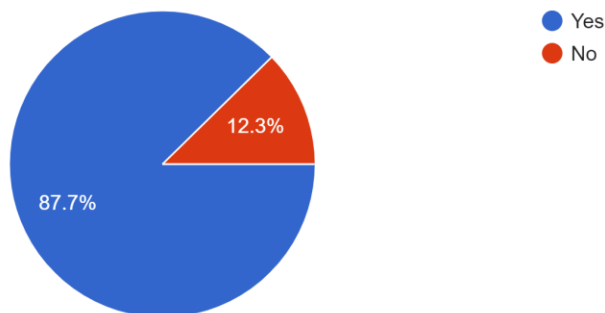


Image 10 – Room measurement chart

Almost 90% of the students say our school meets these standards.

3.5.4. Insulation

The students were asked to express their opinion, on scale from 1 to 4, on the following statement: Our school is properly insulated.

In the chart below we can see that more than 30% of the students disagree with this statement, while almost 50% agree. The rest 20% either completely disagree or completely agree.

Our school is properly insulated.

139 responses

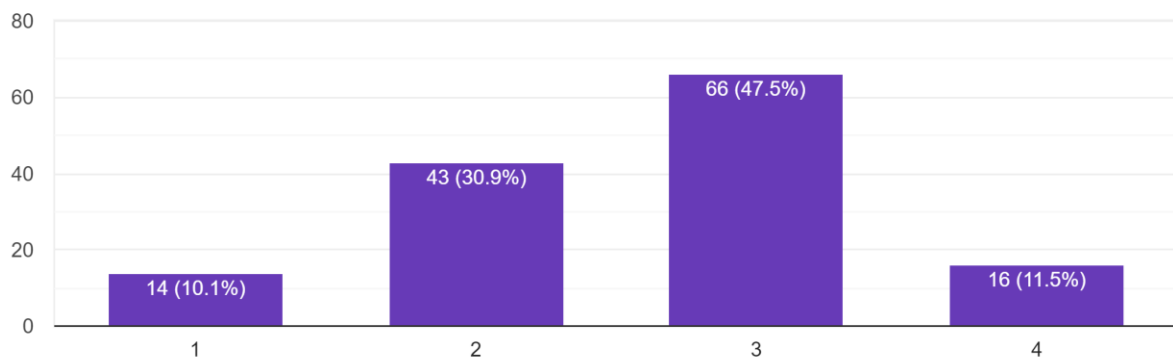


Image 11 – Insulation chart

We can see now that it is hard to judge whether our school building is sustainable or not, based just on the opinion of the students. While the building definitely meets some of the standards, like room measurements, it fails others, like electricity consumption. So, we went further and asked the students to give their personal opinion on how we can make our school more sustainable, because there is always room for improvement. Here are some of the answers:

- Upgrade the heating system;
- Use less paper;
- Better management of electricity consumption;
- Reduce water usage;
- Install solar panels;
- Invest in teaching the students about sustainability.

3.6. Test your knowledge on sustainability with a short game:

<https://wordwall.net/play/9594/753/763>

The game is created using www.wordwall.net. We created it as a fun and easy way to teach our fellow students the characteristics of sustainable housing. The game has also given us the opportunity to see how much teenagers know about the topic. The rules are as simple as this: you have to hit the moles that are correct in order to earn points.

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As you advance through the game, they appear faster and more often, so the player is faced with the same characteristics several times, which helps with memorizing them. In the end you can view the leaderboard and compare your results with other players. From our experience this type of game is very useful in the learning process, the players learn new things without even realizing.

4. Conclusion

To briefly paraphrase, building sustainably is one of the best ways to protect and help the environment, long term. Sustainability should be standard for the 21st century home. It is the small things that lead to the big changes. This past year, we have learned a lot about our planet and how to act in order to save it. After educating ourselves about sustainability, we understood that we could make a difference by sharing our knowledge. It all starts with small steps, like simply acting wiser when it comes to reusing, recycling, or buying.

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House design application: <https://planner5d.com/>

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<https://www.solaripedia.com/images/medium/7068.jpg> (Image 4)

https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcTkZJ5z0JXmA4dxAozb7_XrKXN9D1Z_fG2SGg&u_sqp=CAU (Image 5)

<http://rozenbergquarterly.com/wp-content/uploads/2016/08/Building.jpg> (Image 6)

https://upload.wikimedia.org/wikipedia/commons/0/09/Kolozsvar_Emil_Racovita_Liceum.JPG(Image 7)