Walking friend

Age-group: 12-14 years old
Number of hours: 24 hours + 2 optional school trips
Short description of activity: Students design and build a prototype of a 21st Century Walking frame. In groups, they research on some specific problem of the elderly and design a practical solution to be attached to a walking frame.
CT-competences:

- Data collection
- Data analysis
- Data representation
- Problem decomposition
- Pattern recognition
- Parallelization
- Generalization

Goals

Through the study and analysis of Population Pyramids, students become aware of the problem of an aging Europe. The general problem is narrowed to a specific set of elderly people: those using walking frames. Students analyze this group of users, choose a problem and propose ideas of gadgets that can be used to help them with that problem. Proposals can range from e-health (temperature, pulse, oxygen, blood pressure, etc.) to digital gap narrowing (phone calls, GPS, digital assistant, reminders, etc) to keeping company (Alexa/Siri conversation style) or others.

Realistic STEAM-context

Population pyramids contain geographical, historical, economical, social and mathematical information. Population pyramids change from pre to post war situations, show political decisions like restricting the number of children per couple, and contain information about the last baby-boom. All social sciences can be connected to a graph that is usually only briefly studied in the math curriculum. This entry point where all the subjects that the students have in their curriculum connect to population pyramids will lead to the analysis of the European population pyramid and a reflection on the problem of the aging-Europe. Students will reflect on the problems the elderly have to stay connected to this fast-changing world and how artificial intelligence is still not ready to provide them with personal assistants.

From this generic entry-point, students are asked to add some specific gadget to a walking frame that may help elderly people with their daily needs. They will be asked to justify the need of their solution, as well as the solution itself.

(short justification of STEAM-integration)

The following list summarizes the connections that can be established from our project to

Depending on the student's choices for their solution, the subjects taught in that school-year, the curriculum and the teacher's approach, only some will apply.

Science

- Biology: E-health. The human body. Cells.
- Geology: Batteries and their connection to the environment. Materials and their recycling problem.
- Physics: Forms of energy. Electricity generation and circuits. Simple machines.

Technology & Engineering

- Engineering design cycle: Analysis of the problem, design of a solution, prototyping, evaluation, improvement.
- Technology: Creation of a tangible or a virtual prototype. Depending on the proposed solution, students will be asked to develop a real prototype, a scaled one (wire model, for example) or a virtual one (tinkercad, for example).
- Coding: If students have already been introduced to python or a similar text language, creation of horizontal bar diagrams from vector data.

Mathematics

- Statistics: Analysis and creation of population pyramids (with a spreadsheet software, if possible), real data analysis of the needs of elderly people for their walking frames (gathered on the internet or at a school trip to an elderly home).
- Measurement: Lengths, proportions, scaling, etc for the elaboration of prototypes.

Social studies & Arts

- Economy: Aging europe. Effects on the economy of the EU.
- History: The story told by the population pyramids.
- Arts: Finding beauty in old things (painting, photography, music, etc)

Methodology

Based on learning by doing (with different levels: from imitation to creation). Students, in groups, will generate two outputs: a prototype and a learning portfolio.

Part	Description	Timing
0	**Real world motivation** Not long ago Alexa and Siri did not exist. A little further back, they were just the crazy futuristic idea of some sci-fi writer. Artificial Intelligence is evolving fast, but are we using the technology able to solve real needs? Or are we making up the needs when we have the technology? Do we all need to know exactly how many steps we take daily? Inspiring books and films to encourage this reflection that can be read/viewed and discussed with the students in language lessons are: - Books: The Vestigial Heart (MIT Press): A Novel of the Robot Age (The MIT Press) by Carme Torras. Isaac Asimov stories. - Films: Robot and Frank, Her, I am mother (+14 age-appropriate?), Eva 2011 -Spanish only-, Bicentennial man - TV Series: Humans (age-appropriate?)	2 periods
1	**Portfolio** Students start their digital or paper portfolio with a one-page reflection on the topic. This activity should be performed in their first or second language lessons.	1 period
2a	**Learning our history** Students research the demographic evolution of their own family history. They should collect data about their ancestor's birth places, living places,	2 periods

	number of siblings, number of children, married age, etc. The teacher should focus and explain the differences between rural and urban families. Answers can be graphed as a tree or with a simple infographic.	
2b	**Population pyramids** Students are introduced to the basics of what population pyramids are and how they can be interpreted. With all of this information, attached to the previous activity, they can make a deeper analysis comparing the rural and the urban context using the pyramids as a tool to justify their analysis. Math: use the same software to graph population pyramids.	2 periods
3	**Portfolio** Students perform an analysis on the population pyramid in their country from the above disciplines' perspectives. They have to make a list showing the differences found in the context and the evolution (comparing their grandparents, their parents and them). As an entry point, teachers can ask how come that people live longer now compared with 100 years ago.	1 period
4	**Understanding the human body** Depending on the national curriculum, two entry points can be of use to the topic of aging: 1) Life cycle of cells and types of cells 2) Immune and locomotor systems The connections of these topics with healthy habits and illness prevention should be pointed out. Seeking a higher engagement, we ask students to focus on their own body's cells and/or immune systems.	1 period
5	**Understanding the elderly (I)** The students are asked to research the needs of the elderly and their daily difficulties. In particular, the use and the users of walking frames should be analyzed looking particularly for flaws or improvement opportunities. The main goal of this activity is to connect walking-frames users and their needs that artificial intelligence or other devices might help them to handle. Students are encouraged to accompany some users in their daily routine for first-hand experience on issues such as steps, holes, fast traffic, and the like. The students should take care about the differences between the needs of rural and urban context.	1 period
6a	**Understanding the elderly (II)** If possible, they should prepare a field trip to an elderly home and prepare questionnaires to discuss with helpers and residents their use of walking frames and their general needs. Otherwise, students are encouraged to interview their elders (grandparents, other relatives) to gather the questionnaire's data.	1 day school trip (optional)
6b	**Painting the elder's thoughts** In the first part, students have to question the elderly artistic likings, focusing on musical discipline and taking information about the elder's favorite composers. For the second part, the students have to prepare an instrumental composition. Through this composition, elderly and students do the CSI routine (Harvard mental routine), to achieve the abstractical sequence: Musical manifestation - auditory perception - abstract interpretation - musical thought materialization through painting. In the end they have to compare the routines. Students are requested to understand the music as a way to induce in the listener a pleasant feeling of wellness.	
7	**Data analysis** Gathered data on the flaws of walking frames should be analyzed and graphed adequately with some spreadsheet software. Depending on their	1 period

	approach to the problem, graphs may reflect the prospective number of users, the questionnaire quantitative analysis or other. (The main idea is to express quantitative information using IT tools). Data obtained from the interviews with the elders will be represented by folksosnomies/conceptual maps/summaries using IT tools. Children should make a mixed analysis with quantitative and qualitative data.	
8	**Portfolio** Students write down their analysis using both text and graphics to support their conclusions on the problem.	1 period
9	**Narrowing down** Students in groups choose a particular problem that has been noticed during the analysis phase and research deeper into that topic. Each group presents the results to the rest of the class and **all involved teachers** to gather further insight. Groups are assigned to different teachers (who will be mentoring them) depending on the subject that appears to be the most relevant to their approach. Each teacher should be assigned to, at least, one group of students.	2 periods
10	**Portfolio** Students will prepare musicograms elements (genial.ly or similar software may be used in their Arts class), they represent a musicogram of the song with which they work the CSI routine with the elderly person and include it in their learning portfolio either in their mother tongue or as part of their second language learning activities.	1 period
11	**Solution design** Students work on the design of their solutions. Mentors are asked to find the connections to each subject in the students' curriculum and highlight them. A common board called **"Learning Needs"** should be used (for example, with post-it) to add the topics in the curriculum that students would need to research for their solution. All teachers are encouraged to review the board often and to try to accommodate those topics in their lessons for the whole class, explaining why that topic is relevant to which group. For example, if a group is trying to connect an Arduino to the walking frame, the Physics teacher might be asked to review solar panels and electricity generation.	1 period
12	**Solution implementation** Students work on their prototypes. Each group has a daily or every other day 5 minutes update with their mentor explaining their progress, the techniques they are using, what they have learned and any issues that might be hindering their work.	6 periods
13	**Portfolio** Students should reflect and document their learning about virtual prototyping, planning, scaling, handcraft work, etc.	1 period
14	**Solution preparation** Students prepare a 6 minutes pitch presentation of their work and learning process along the weeks the project has been implemented.	1 period

15	**Solution presentation** If possible, they visit the same elderly-home and present the residents with their process (beware not to focus on the final results but on the learning path). Otherwise, these presentations should happen in a school event with other students and/or parents.	1 day school trip (optional)

Organization

Materials:

- Depends on the problem, the solution, and the school. As a general rule, prototypes should be built with recycled materials and with the available elements from the school lab. Cheap solutions should be encouraged when they are essential to the prototype.

Use of ICT: Tinkercad, sensor data gathering, arduino/scratch programming, etc

Coaching

Useful questions:

Task 0-1

- Are we using the available technology properly to solve real needs? Are we making up the needs when we have the technology?
- Do you have a fitness band? Do you actually need to know exactly how many steps you take?
- Are you worried this data might become public? What if you had some heart condition and your future employer could know of this?
- Are street cameras helping us be safer? Or are they a leak on your privacy?

Task 2a-2b-3

- Given a particular population pyramid, ask the students, in the following order: What do you see? What do you think? What do you wonder? Let them answer each other questions and/or research following their curiosity.
- Given two pyramids, compare them. Find similarities and differences. Can they be the before/after of some community? How?
- Which differences can we find between population pyramids in the two different contexts? (compare and contrast recommended).
- Why do people go from the villages to the big cities? Which consequences has the population losing/growing?

Task 4

- How would you like to age? How can you better take care of your own body?
- Do cells in your body regenerate? Which ones and how often?
- Do you have scars? Could they have been prevented from happening?
- Have you had sprains or broken bones? Other locomotor injuries?

Task 5-6a-6b

- What do you know about elderly people? Do you usually talk to elder relatives?
- How would you start a conversation with them?
- Do you think some questions might make them feel uncomfortable? Which? How?
- How can you find out their particular needs?
- How can you express pictoricaly through music?
- How can you introduce music to make the elderly wellness improve?

Task 7-8

- Are all graphs equally adequate to represent data?
- How can you reflect the data you’ve gathered? Is all your data quantitative?

- Did you also gather qualitative answers? How can you represent those?

Task 9-10

- How can you convince your mentor that your idea has potential?
- Do you really want to learn more on those topics? Do you like your project?
- Why did you choose your idea?

Task 11

- Can you explain in 4/5 sentences what you need to do? Can you transform them into a timeline of what needs to be done?
- Can any of those tasks be done at the same time? (In parallel) Or do all of them need to be sequenced in a particular order? (Sequentially)
- Is there a task that none of you feel able to carry out? (Talk to your mentor about it!)

Task 12-13

- Are you following the plan? If not, Why not? What can each member of the group/your mentor do to solve it?
- Do you need to make adjustments to your plan? What do you need to review/change from your design? (Engineering cycle)

Task 14

- What have you learned in these weeks?
- How did you learn it? Did you learn more from your mistakes or from your successes?
- Does your portfolio show both what you missed and what you did well from the beginning?
- Are you proud of what you have accomplished? If not, What would you change if you were allowed to start again?
- Have you taken into account the rural/urban context to design the project? How?

Stimulation of cooperation:

Teamwork:

- Groups should consist of 3 students. Whenever possible, we should try to match high-achieving students with highly creative students and committed students. (See https://renzullilearning.com/wp-content/uploads/2019/08/EnrichmentClusters.pdf for a deeper anylisis on enrichment clustering.)
- Sometimes, gender-balanced groups tend to split the work following stereotyped roles (boys do the technical job, while girls focus on the higher level tasks). We recommend some intervention to balance these roles, if they appear.
- The teacher should be aware of the skills each group has, and cover up for their deficiencies in the following set of skills:
    - Spatial orientation
    - Handwork
    - Research & Documentation
    - Empathy & Caring instinct
    - Creativity
    - Pragmatism
    - Industrious

Formative assessment:

Students should be encouraged to concentrate on the process and not the final result. Mentors shall communicate often with each other to remark student's improvements or learning needs. Grading should never be based on their final prototypes but on their learning portfolios, presentations and developed skills.

Adaptations

General ideas:

In the 3-6 ages, only the first sessions on becoming aware of other people's needs and the help of Artificial Intelligence can be adapted.
For 6-9, they can go one step further, arriving to the design of solutions. Population pyramids shall be replaced by histograms.
In the 9-12 group, the activity can be kept approximately the same, but deepening on the human body aging process, while lightening the technological/prototyping parts.

Tips & tricks

Useful web pages for the qualitative data analysis:

Concept map: https://www.mindomo.com/
Folksonomy: http://ww7.wordle.com/

CSI routine:

This routine asks students to identify and distill the essence of ideas from reading, watching, or listening in non-verbal ways by using a color, symbol, or image to represent the ideas.

1. Select a color that best represents the essence of that concept.
2. Construct a symbol that best represents the essence of that concept.
3. Draw an image that best represents the essence of that concept.

With a partner or group, first share your color and then share the item from your reading that it represents. Tell why you chose that color as a representation of that idea. Repeat the sharing process until every member of the group has shared his or her Color, Symbol, and Image.

For more information read
http://pz.harvard.edu/sites/default/files/Color%20Symbol%20Image_1.pdf

CSI organizer

Colour - Symbol - Image

 COLOUR What colour best represents this?	 SYMBOL What symbols best represents this?	 IMAGE What image best represents this?
Why did you choose this colour?	Why did you choose this symbol?	Why did you choose this image?

Adapted by Alice Vigors 2017