GEM Empower Girls to Embrace their Digital and Entrepreneurial Potential

GEM Guidelines

How to organize successful

STEM summer camps for girls

Deliverable 2.1

Updated version, February 2022.

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Introduction

The GEM-project

The GEM project - Empower Girls to Embrace their Digital and Entrepreneurial Potential, is a European Union co-funded pilot project running from 2020 to 2022. GEM aims at encouraging girls' interest in STEM and ICT subjects and inspiring them to choose careers and become entrepreneurs in these fields. To achieve this aim, the project consortium organizes exciting cost-free summer camps for girls aged 12-18 and establish a wide-reaching network of schools, higher education institutions, companies and policy makers, thus supporting girls in pursuing STEM pathways on all educational and professional levels.[1]

The summer camps have their focus on inspiring girls and offer them the opportunity to enjoy STEM in an inclusive and supportive educational environment, working jointly on a variety of STEM projects. GEM Summer Schools create a space where girls learn about, from and for STEM and each other and take many positive experiences home.

The guidelines

The aim of the guidelines for organizing STEM summer camps for girls is to support partners and other countries and institutions in planning, performing and evaluation of summer schools. The main elements of these guidelines are research-based starting points for organizing these summer camps, exemplary activities and materials for projects and pedagogical formats with a STEM, ICT and entrepreneurial focus, and a roadmap description of all necessary steps (preparation-operation-evaluation-follow-up) involving possible costs, resources and infrastructure.

The guidelines are adaptable to national contexts and help interested stakeholders to organize their own future summer camps, or similar events, in various local settings across Europe. Drawing from our guidelines users can choose suitable pedagogical approaches for their particular learning purpose (e.g. stakeholders might locally wish to focus on developing entrepreneurial mind-sets, acquiring digital subject knowledge or inspiring through role models and thus the combination of activities varies). This is expected to strongly facilitate the willingness to perform similar measures as well as increase the probability that future activities will run successfully.

[1] https://icse.eu/international-projects/gem/

Update of the guidelines (December 2021)

An initial set of guidelines was developed prior to the first pilot camps in 2020.
In this updated version we are able to use the experiences from all summer camps in 2021 (see **Report on piloting and evaluation of European GEM summer camps**, December 2021, WP 3 - Piloting and Evaluation).

Structure of the document

This guideline document consists of three main sections.

- In the first section literature is discussed, and suggestions for the content and pedagogical formats of STEM summer camps for girls are derived.
- This theoretical section is followed by practical gidelines for organizing STEM summer camps for girls. a description of necessary organizational steps for preparing, operating and evaluating summer camps, including possible costs and requirements for resources and infrastructure. This section describes guidelines to support the planning, performing and evaluation of summer schools involving example lists of regional partners (industry in the region, associations in the area, parents with science/ICT/entrepreneurship related jobs, etc.) willing to cooperate. This section will also provide suggestions for how to adapt the general guidelines to national contexts with references to the Summer Camp support website (GEM Deliverable 3.1) and the Summer Camp Learn Plan (GEM Deliverable 3.2).
- The practical guidelines are followed by a checklist of do's and dont's for organizing the camps.
- The final section consists suggestions for activities and a reference list including suggestions for further reading.

Theoretical starting points

The guidelines for organizing summer camps are based upon published research and experiences. The findings from relevant publications are grouped in two categories. First, publications relevant for the content of the activities during the summer camp are listed, and next publications relevant for pedagogical formats of these activities are summarized.

Content of activities the Summer Camp

- Show how STEM skills can be used to help others (Milgram, 2011). Research shows that, as a group, women care most about how STEM will be used to make a difference in the world, such as using engineering to make prostheses, while men are often fascinated with the technology itself. Moreover, based on our pilots we advise to avoid activities that resemble school STEM practices.
- Socio-scientific issues (SSIs) are promising contexts for addressing the role of science in society (e.g examining issues from multiple perspectives and involving skepticism when discussing potentially biased information (Sadler et al., 2007). SSIs can motivate girls to illustrate how STEM can make a difference and consequently get involved in STEM activity.
- In line with the promising role of SSIs is the advice to use authentic contexts that are derived from current societal issues such as climate change, waste reduction and animal welfare (Chapman & Vivian, 2016).
- Types of contexts that raise girls' interests relate to STEM fields which bear socially positive potential: Health and medicine, beauty and the human body, ethics, aesthetics, wonder, speculation (Sjøberg & Schreiner, 2010).

Pedagogical formats of activities

- Girls require a special culture of feedback, e.g. in case of 'failure' refer to a lack of effort instead of competence, and give girls opportunities to experience success and have it recognized (Jahnke-Klein, 2001). Consequently, invite for contributions and allow mistakes, promote feelings of ownership and empowerment among the participating girls (Boaler & Dweck, 2016). Such activities contribute to a culture of feedback that reaches girls, let them overcome feelings of uncertainty, and create a culture of belonging.
- Gender-neutral and safe learning environment in which girls feel confident to try things out and push their "comfort zone" to make progress are a precondition for successful female performances (Sammet et al., 2016). Again, attention for a feeling of belonging is important (to girls) (Blickenstaff, 2005; Rainey et al., 2018) which means that summer camp guides need to introduce activities with explicit attention for success experiences, allowing for mistakes and promoting ownership. Our

pilots showed also the importance of ice breaker activities and games to help students to get to know each other.

- Use female role models with careers in STEM sectors (COM, 2007). Girls need to see female role models in the workplace that look like them. They need to receive the message that women can work in STEM careers and be successful and fulfilled in their work life while still having a personal life, and they need to receive this message repeatedly (Milgram, 2011). Provide for instance a historic and a modern review of female STEM role models (Bielefeld, 2019), or visit workplaces involving female scientists.
- Use (young) female lecturers and mentors as there is a positive and significant association between the proportion of female teachers in a high school and the likelihood that a female student will choose a STEM-related major (Stearns et al., 2016). Our pilots show that it is recommended that mentors leading group work attend training sessions prior to the summer camps in which they can be briefed about pedagogies and STEM-related content.
- Active engagement in inquiry-based and hands-on lab activities apparently were shown beneficial for girls (Patrick et al., 2009; Sadler et al., 2007). For example, by letting them build large artificial, moving animals you can create a fusion of art and technology – with curiosity, imagination, and play with a hands-on construction materials (Thuneberg et al., 2018). Girls working in groups and supported by an adult leader (mentor) proved to be very successful during the GEM pilots. Groups of around four students worked very well (either allowing students to work with their friends or with different students).
- Consider girls' institutionally narrated identities in school practice often oriented on finding the right answers. For stimulating girls to pursue science careers avoid school practices and engage them in authentic science practices (in middle school) (Tan et al., 2013).

Practical guidelines

Duration

The length of the summer camp and of each day needs to be considered. We experienced a variation of one-day camps up to five days. Most partners piloted a two-day summer camp. During these pilots the girls reactions on length were quite varied. Some students asked for more activities and summer camps lasting multiple days, while others were tired towards the end of the day. Consider small breaks for girls unofficially talk to mentors. In case the length of the camp exceeds one day, you need to consider whether you offer overnight accommodation. An alternative is that parents bring their children to the location every morning and pick them up after the activities. Striking a balance between types of activities and length of each summer camp day requires trials and adjustments in your national context.

Mentors

A very interesting characteristic of a Summer School is the involvement of mentors: female experts in the STEM area. Some countries involved those female experts in the design of the activities or by assigning groups of students to join their research work for the duration of the summer camp. Other partners involved young female mentors with a STEM-related background as adult group leaders and session leaders. In this way a mentor would follow a small group of students for the duration of the summer camp.

These mentors can be academic staff, higher education students or (future) teachers. In general they need a training to become familiar with the specific pedagogical guidelines and the content of the activities.

In order to explicitly address the need for role models you can involve a 'Girl of the day'. This girl is a woman/girl that is invited in the Summer School to give a short presentation about her work, with a special emphasis on the STEM characteristics of her work. This gives the participants a role model, and a dedicated view of the kind of work and 'the daily practice'. She can also mentor during the activities of that day.

Recruitment of participants

Consider a variety of strategies and campaigns to recruit your participants including the use of spreading catchy messages through social media. It is recommended to set up a summer camp support site with details about the camp and registration links for joining. The list below of shows a variety of strategies and tools that can be selected and tuned to local situations.

- Disseminate the Summer camp support site among schools and teachers in your region
- Use channels available on social media (FB, Instagram, Twitter, LinkedIn)

- Advertise the camp through newsletters of your university, for teachers or from teacher associations
- Try to reach newspapers, radio and tv through a press-release
- Advertise the camp at local teacher conferences, seminars and university activities with (digital) leaflets and posters

In case more girls are interested than can be accepted, consider:

- Accept students on a first come first served basis.
- Give priority to girls with no STEM background (e.g. girls whose parents do not work in STEM fields).
- Try to diversify girls' profiles (e.g. trying not to take more than four girls from the same school).
- Having participants with a wide age range (e.g. 12-16) may present a challenge. This may be solved by grouping the students into smaller sets with a smaller age range (e.g. 12-14; 15-16).

Resources needed for the activities

The resources needed highly depend of the type of activities that you organize. Since these activities vary from designing escape rooms, using 3D printers, doing lab work, designing tessellations, etcetera, not one recommendation can be made. Take care of possibilities to have groups share their findings and results of group work by preparing poster materials, markers and other materials for visualization or an exhibition. Consider certificates for the participants.

Budget

Also a budget depends on the length and local situation. When you are able to organize meetings at a university the workshop rooms are often for free. When you organize the camp out door, you might need facilities of a youth hostel and maybe also facilities for meals and accommodation for overnight. A very rough estimate of a four day summer camp could be that you need € 7500 euro for organizing a summer camp and ask a participation fee of € 300 including accommodation, meals and resources for the activities (with an estimation of 25 participants).

Meeting rooms	€ 1000 (including drinks)
Overnight accommodation	€ 2500 (€ 40 euro per night; 3 nights and 25 participants)
Meals	€ 2000 (€ 20 euro per day; 4 days and 25 participants)
Resources	€ 1000 (depending on your activities)
Personnel costs	€ 1000 (student assistants)

National contexts

The general guidelines in this document need to be tuned to national contexts and the infrastructure of the organizing institution. The report on piloting and evaluation of European GEM summer camps 2021

shows the rich variety and local choices in each of the participating countries. For more information you can read these reports or explore and contact local organizing teams. Include links to the local GEM support websites:

- The website of the German GEM support site: https://icse.ph-freiburg.de/gem/gem2021/
- The website of the Spanish GEM support site: https://gem-esp.eu/
- The website of the GEM support site in Lithuania: https://www.fsf.vu.lt/mokslas/projektai/tarptautiniai-projektai/europos-komisijos-programos?layout=edit&id=2937=empower-girls-to-embrace-their-digital-and-entrepreneurial-potential-gem
- The website of the Swedish GEM support site: https://upptech.se/komteks-fritidskurser/teknikkollo-2021-pa-upptech.html
- The GEM support site in Malta: https://www.um.edu.mt/educ/ourresearch/gem
- The website of the Greek GEM support site: http://scholar.uoa.gr/gpsych/GEMSummerCamp2021
- The GEM support site in Cyprus: http://www.girls4stemcyprus.com/
- The Dutch GEM support site: https://elbd.sites.uu.nl/2019/12/06/gem/

Roadmap for organization

Organizing a summer camp for girls requires measures for preparing the camp as well as a schedule for the camp itself. The preparation as well as the day-to-day program can be visualized in a roadmap. This roadmap supports institutions that plan organizing such a summer camp and provides a variety of possible adaptions for usability within our project partners. In general, the organization of a summer camp will follow six steps:

Step 1:	Meeting with the organizing team, choose a topic, set up a financial and technical plan for the summer camp, and decide how to involve mentors. If needed, consult your local GEM support team (see the websites above).
Step 2:	Developing a concept with involvement of STEM partners and representatives from the World of Work (e.g. participation of a Girl of the Day representing the WoW) to ensure fostering entrepreneurship among the girls. Checking if the resources and expertise (e.g. camp trainers) is given (including role models). Finalizing budget and decision on participation fee.
Step 3:	Setting up a homepage with application system. Promoting the Summer Camp at schools, ministry of education, partners, social media channels (see list above). Train/inform the mentors and other involved staff on content and pedagogical guidelines.
Step 4:	Organizing transportation/hotels, laboratories and rooms. Order and organize necessary materials (including certificates). Prepare day-to-day program(s). Inform local authorities and create a press release.
Step 5:	Run the Summer Camp (if possible: update others, parents, etc. through posts on social media).
Step 6:	Evaluation of the Summer Camp, reporting in social, public and professional channels.

An example roadmap for organizing a camp of a National GEM Team (NGT) is provided in Figure 1.

RoadMap Girls Empowered - Version 2020 **Target - Activity in Autumn 2020**

		Action	Details
2020	**April**	(Virtual) Meeting with the NGT	Finding the date for Autumn 2020 (maybe not a camp, but a day)
	May	Design a Flyer (pdf) for communication	
		Mail to all national institutes involved	Save the date mail
		Start website	
	June	First (virtual) meeting with all 'camp-trainers'	Setting up the program
		Mail to all national institutes involved	Invitation with possibility to enroll
		Working on the details of the program	All camp-trainers involved are designing elements of the program
	July	Second (virtual?) meeting with all 'camp-trainers'	
		Finalizing the program with all details	
		Update website	
	September	Third meeting 'camp-trainers'	Getting through all details. Final remarks. Check of materials
	October	Activity	

Figure 1: Example roadmap for organizing a GEM summer camp

Figure 2 is a screenshot of a part of a tentative day-to-day program for a summer camp in Spain.

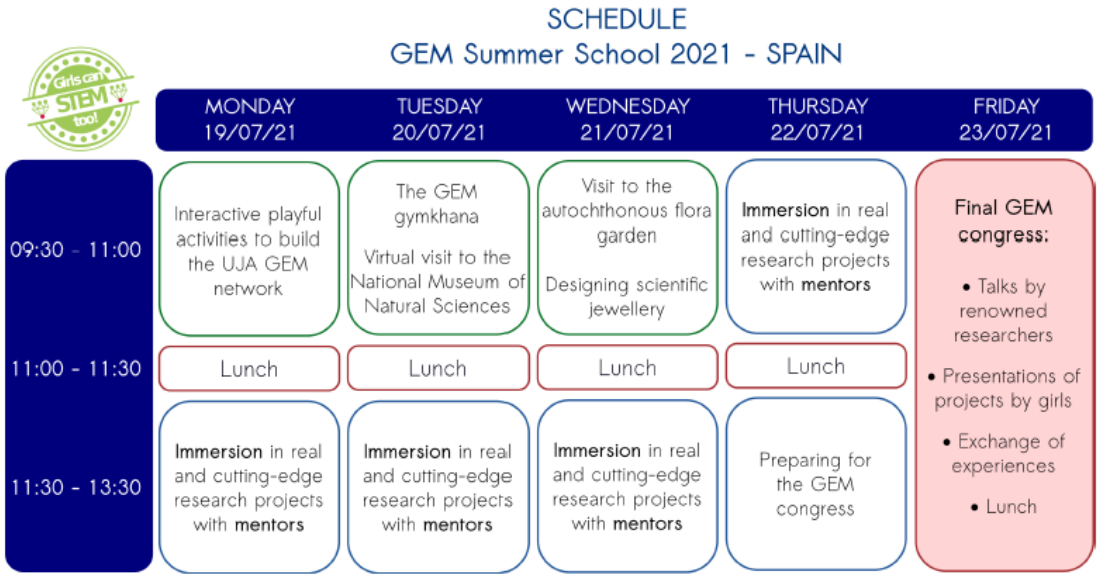

Figure 2: Example day-to-day program for a summer camp in Spain

Do's and don'ts

The practical guidelines for organizing summer camps for girls are summarized in a list of DO's and DON'Ts:

DO

- The summer schools should allow for time for group building especially if girls come from different schools are involved.
- Create inquiry-based activities during which girls can do science, explore and be creative in contexts where science makes a societal difference or relates to social scientific issue (Patrick et al., 2009; Sadler et al., 2007; Thuneberg et al., 2018). Prepare final sessions for exchanging findings or an exhibition of results.
- Do include female role models (also as lecturers) but take care to not make it seem like something outstanding, more that it is/should be common, that woman work in those fields. Consider small breaks for girls unofficially talk to mentors and representants of the world of work.
- In advertising emphasize social aspects of the event and opportunities for girls to work together (e.g. call it a girls club).

- If there are limitations to organize a live summer school (e.g. because of COVID) we recommended to organize a reduced program online. We have good examples of how to organize activities online.
- Invest in setting up a community (e.g. create a WhatsApp-group).
- Encourage two or more girls from the same class/school (makes it 'low floor' and also is helpful for transportation).
- Emphasize the importance of STEM for society and responsible citizenship.
- Emphasize social aspects, be part of a community, including meetings with role models.
- Take care that parents know the program and can support.
- Include female role models and organize meet & greets.
- Invite girls and women to tell about the kind of work they do and how they use STEM skills.

Don't

- Don't emphasize that you need to be high-achieving in STEM.
- Don't forget time for ice breakers at the start, meetings with mentors during, and sharing findings at the end of the summer camp.
- Don't use too sophisticated words (in interaction, in communication).

Suggestions for activities

As stated in the introduction the first general objective of this proposed GEM project *is to inspire and enable Europe's girls to tap their STEM, digital and entrepreneurial potential.*

The first round of summer camps for girls in 2021 has brought a load of inspirational activities, positive experiences with STEM content, especially ICT, learning from inspiring (female) role models and developing an entrepreneurial mindset and transversal skills.
Inquiry based learning is used through most of the activities. This ensures attention for transversal skills throughout the activities. Characteristics of these activities are for instance that they are 'meaningful for others' and are linked to real life and to the STEM/digital world of work in the students' own region. For more characteristics see the section on Theoretical starting points.

Below we list activities that can be implemented in summer camps. All activities are exemplary and can be changed and adapted in the design-process of setting up the summer camp program. In the appendix we add a list with sources and tools that will help in (re)designing these activities. When adapting it is important to make sure the activities contribute to at least one of the aims: STEM-content, ICT/coding, role models, world of work, entrepreneurial mindset. Although the aims are general to the project, activities contributing to those aims may differ from country to country.

List of suggested activities
Activities related to ICT/Coding/programming[2]
Unplugged activities related to 'ideas behind coding'
Programming for example little robots, lego mindstorms, tools, drones or Arduino's to do specific tasks, or program a computer game using scratch or Python
Programming and using devices/sensors for measuring in everyday life (related to STEM areas)
Explore and create digital tools and programs to promote health and wellbeing.
Debate ethical issues related to the digital world: privacy, hacking, etc.
Activities related to STEM
Lab & technological work (e.g. using sensors, 3D-printing) on processes, products and experiments related to everyday life (food, cosmetics, water, weather) and girls' main interest.
Covid-19 related topics (e.g. how viruses work, epidemic models, sampling and data visualization, informing and changing behavior of the general public, the role of science/scientists) https://epiclearning.web.unc.edu/covid/
Outdoor STEM activities with apps on digital devices for example: - Math 'tours' in the city https://mathcitymap.eu/en/ - Environmental research about types of soil, wild birds, mice on fields, water, the weather https://icse.eu/up-in-the-sky-exploring-space-with-a-weather-balloon/
Activities related to role models
Explore the contributions of women to science and their 'lives' (both from history and current days). For example, by inviting young female scientists or representatives of the world of work to speak about their personal stories (e.g. Girl of the Day).
Activities related to the world of work and entrepreneurial mindset
Engaging groups of girls with activities that might be divided and explored through different lenses from STEM subjects and workplace professionals.
Study urban architecture, by a lecture on: How to make a town friendly for citizens? Architecture as a participatory activity and a vehicle to shape and improve our society taking into account sustainability issues.
Activities in collaboration with existing science and technology centers/museums and with industry/small business

Besides the examples listed above and the Case Studies from GEM 2021 (see the Report on piloting and evaluating European GEM summer camps, December 2021) we encourage to make use of resources

[2] See also: https://www.coding4girls.eu/

from other EU projects in which one or more of the partners participated, such as Mascil, Masdiv and IncluSMe (see https://icse.eu/international-projects/).

One of the products we are currently working on is bringing together the 'strongest ideas' of the GEM Summer Camps in an online repository. This will be arranged in the tradition we already have in the ICSE consortium: https://www.fisme.science.uu.nl/publicaties/subsets/icse_en/
From January 2022 and onwards we will publish a special GEM collection subset.

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Appendix

type	category	Title/topic	url	
source	coding	code.org	Code.org	
source	coding	Code Kingdoms	https://codekingdoms.com	NL
tool	coding	cubelets	http://www.modrobotics.com	NL
tool	coding	scratch	scratch.mit.edu	NL
tool	coding	simsketch	http://modeldrawing.eu/our-software/simsketch/	NL
tool	coding	ozobot	ozobot.com	NL
source	empower	female stem role models	https://blog.mimio.com/female-stem-role-models-increasing-girls-in-stem-fields	MT
source	ibl	everyday life consumption		CZ
source	ibl	inclusme	inclusme-project.eu	SK
source	ibl	urban architecture	https://en.wikipedia.org/wiki/Urban_design	SK
tool	coding	arduino	arduino.cc	DE
source	ibl	science musea	https://herakleidon-art.gr/	GR
tool	coding	lego mindstorms	mindstorms.com	NL
tool	coding	python	python.org	DE
source	coding	lego league	firstlegoleague.com	NL
tool	coding	blockly	blockly.games	NL
tool	coding	javascript	developer.oracle.com/javascript	NL
tool	coding	swift	swift.org	NL
source	coding	cs-unplugged	csunplugged.org	NL
source	coding	legowedo	https://education.lego.com/nl-nl/lessons/wedo-2-science	NL
source	ibl	augmented/virtual reality		NL