IO1. STEAMitUp Toolkit

Best Practices and OERs'

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Best Practices and OERs (Open Educational Resources)

Overview

In an effort to promote STEAM education across EU and beyond, a list of 25 best practices have been identified as a result of an extensive desk research that has been conducted by the STEAMitUp consortium. The list of BPs' is presented in a tabular format and consist of various EU exemplars including strategies, methods, technological tools, applications and materials that can be used to cultivate students' digital skills (such as problem-solving, critical thinking and collaboration).

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Best Practice 1	in2steam
1. Topic/ Area	STEM/ Girls Education
2. Title	STEM
3. Type of Best Practice	✔ Online Training Curriculum in STE(A)M learning and gender sensitive practices. ✔ Report on the value of STE(A)M in Girls' education ✔ Digital Teacher's Toolkit (DTT) with STE(A)M activity kit for primary school ✔ European Charter for STE(A)M Education and Impact report
4. Date released	2019
5. Partners/ network	✔ CESIE [Coordinator], Palermo, Italy, www.cesie.org ✔ Danmar Computers LLC [Partner], Rzeszów, Poland, www.danmar-computers.com.pl ✔ INOVA+ [Partner], Porto, Portugal, www.inova.business ✔ Four Elements [Partner], Athens, Greece, www.4-elements.org ✔ CARDET [Partner], Nicosia, Cyprus, www.cardet.org ✔ DOĞA SCHOOL [Partner], Istanbul, Turkey, www.dogakoleji.k12.tr ✔
6. Description of the methods/ approach	STE(A)M is an educational approach to learning that uses Science, Technology, Engineering, the Arts and Mathematics as

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	access points for guiding student inquiry, dialogue, and critical thinking and the acquisition of these competences. It incorporates gender-inclusive teaching methods and open resources focused on STE(A)M learning in primary education; to foster creativity, critical thinking and problem-solving competences among young pupils in STEM.
7. Purpose/Aim	The current best practice aims to increase the competence development of teachers and educators, to increase and nurture girls' interest in STEM fields and support the interest in STEM disciplines.
8. Evaluation (results) of its effectiveness (if applicable)	N/A
9. Overview of the lessons learned which are relevant to the project	N/A
10. Web link	https://in2steam.eu/

Best Practice 2	SCIFUN
1. Topic/ Area	Science Education
2. Title	Science Fun
3. Type of Best Practice	✔ Guidelines and ideas for designing learning activities ✔ Piloting the toolkit in all countries: Case studies ✔ Collection of Best Practices for Making Learning Science ✔ Recommendations for utilising comics, mobile devices, digital storytelling, and social media
4. Date released	2015
5. Partners/ network	Project Co-ordinator: The Group for European Integration (GIE), www.gie.ro Project partners: ✔ Louth Meath Education and Training Board – LMETB, https://www.lmetb.ie/ ✔ University of Pitesti (UPIT), https://www.upit.ro/ ✔ CARDET, https://www.cardet.org/ ✔ The University of the Peloponnese, http://www.uop.gr/ ✔ University of Lodz, https://iso.uni.lodz.pl/ ✔ INNOVADE LI (InnovADE), http://www.innovade.eu/

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6. Description of the methods/ approach	This project proposed that an approach to enhancing student interest for science can be conceptualized through the design of science curriculum materials that focus on making learning science fun, by supporting personalized, meaningful, situated, and contextual learning.
7. Purpose/Aim	The aim of the project was to address the challenge of engagement in science through an innovative approach to science teaching and learning and make learning science Fun and Relevant to students' contexts. The project aimed to increase pupils' motivation and achievement in science and other subjects and to prepare European educators to better engage pupils in science education. Mainly, the aim of SciFuN is to develop an online toolkit, which will be composed of the following sections: • Prepare European educators to better engage pupils in science education. • Prepare European educators to better engage pupils in science education. • Describe general approaches and specific methods and techniques to teach key competences and concepts in Science and other important areas of the curriculum. • Support educators in utilizing mobile devices (GPS, PDAs, Tablet PCs), comics, digital storytelling, film, multimedia, and Web 2.0 technologies to engage students in Science education. • Support educators in utilizing mobile devices (GPS, PDAs, Tablet PCs), comics, digital storytelling, film, multimedia, and

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	Web 2.0 technologies to engage students in Science education. • Support educators in utilizing mobile devices (GPS, PDAs, Tablet PCs), comics, digital storytelling, film, multimedia, and Web 2.0 technologies to engage students in Science education.
8. Evaluation (results) of its effectiveness (if applicable)	For research and dissemination check here https://www.scifun.eu/index.php/en/outputs
9. Overview of the lessons learned which are relevant to the project	Produced Global STEM Challenges linked to the UN Global Goals (also known as the Sustainable Development Goals)
10. Web link	https://www.scifun.eu/index.php/en/
11. References/ online sources	https://www.scifun.eu/index.php/en/

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Best Practice 3	
1. Topic/ Area	STEM/ Girls Education
2. Title	Girls into Global Stem (GIGS)
3. Type of Best Practice	✔ Intellectual Output 1: Global STEM Challenges ✔ This was the focus in Year 1 leading to the development of innovative methodologies and the students' eBooks ✔ Intellectual Output 2: Teacher Training Materials. We are developing teacher training in a variety of formats including an online course ✔ Intellectual Output 3: Teacher Toolkit See www.gigstoolkit.com for further details ✔ Intellectual Output 4: Training Curriculum
4. Date released	2016
5. Partners/ network	✔ Project Co-ordinator: The University of Hull (UK) Project partners: • Practical Action (UK) • Centre for Citizenship Education (PL) • Centre for Advancement of Research and Development in Educational Technology Ltd-CARDET (CY) • University of Boras (SE) • de Ferrers Academy (UK) • Zespół Szkół w Siennicy (PL) • The Grammar School, Nicosia (CY)

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	• Sandgärdskolan (SE)
6. Description of the methods/ approach	The project developed innovative methodologies such as sustainable development goals, climate action and more as well as the students' eBooks which are available here http://gigstem.weebly.com/io1-global-stem-challenges.html
7. Purpose/Aim	The "Girls into Global STEM" (GIGS) project aims to increase the employment potential of all young Europeans, but especially girls, by improving their interest and engagement in STEM subjects through linking these to a wider awareness of global issues. More precisely, the objectives of this project were: • To increase the employment potential of young Europeans, especially girls, by improving their interest and engagement in STEM linked with wider awareness of global issues and facilitated through digital skills. • To support teachers in the embedding of digital skills and global learning methodologies into their STEM teaching • To integrate digital literacy set within a global context into STEM education policy and practice
8. Evaluation (results) of its effectiveness (if applicable)	For research and dissemination check here http://www.gigstoolkit.com/research-and-dissemination.html

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9. Overview of the lessons learned which are relevant to the project	Produced Global STEM Challenges linked to the UN Global Goals (also known as the Sustainable Development Goals)
10. Web link	www.gigsproject.eu

Best Practice 4	STEAME
1. Topic/ Area	"STEAME" Science, Technology, Engineering, Arts, Mathematics and Entrepreneurship"
2. Title	STEAME: Guidelines for Developing and Implementing STEAME Schools"
3. Type of Best Practice	• Guidelines for dynamic and adaptive STEAME curricula • Guidelines for STEAME Activities in Schools for two age groups • Guidelines for STEAME School Organizational Structure
4. Date released	2019
5. Partners/ network	**Coordinating Organization** Cyprus Mathematical Society - Cyprus **Partners** • Cyprus Pedagogical Institute - Cyprus

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	• Pedagogical University of Krakow - Poland • Prof. Ivan Apostolov Private English Language School - Bulgaria • Institute of Accelerating Systems and Applications (IASA) - Greece • Douka Ekpaideftiria AE-Palladion Lykeion-Doukas School - Greece • ITC Pacle Morante Limbiate - Italy
6. Description of the methods/ approach	N/A
7. Purpose/Aim	The project intends to develop a prototype school structure design with suggested dynamic curriculum, activities, learning and creativity plans and methods, developing also a training course for training teachers on how they can work effectively and productively under a STEAME school.
8. Evaluation (results) of its effectiveness (if applicable)	Journal of STEAME Creations for and by School students https://steame.eu/journal-of-steame-creations-for-and-by-school-students/
9. Overview of the lessons learned which are relevant to the project	N/A
10. Web link	www.steame.eu
11. References/ online sources	https://steame.eu/news/

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Best Practice 5	mascil
1. Topic/ Area	Science, Mathematics education, General education and e-learning.
2. Title	Mathematics and Science for life
3. Type of Best Practice	mascil toolkit Toolkit for teacher PD The World of Work IBL & WoW in classroom

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	mascil final conference Educating the Educators II Teachers' e-learning platform platform, which hosts *e-learning* courses for teachers
4. Date released	2013
5. Partners/ network	thirteen countries represented by the partner universities and institutes of mascil: University of Education Freiburg, Germany http://mascil.ph-freiburg.de Utrecht University, Netherlands http://www.projects.science.uu.nl/mascil/ University of Jaén, Spain http://www.ujaen.es/investiga/mascil Norwegian University of Science and Technology (NTNU), Norway http://mascil-norge.org Hacettepe University, Turkey http://www.mascil.hacettepe.edu.tr/ Babes-Bolyai University, Romania http://simplexportal.ro/mascil-project.ro University of Hradec Králové, Czech Republic http://ris.uhk.cz/mascil/ Divulgación Dinámica S.L. (Dynamic Disclosure S.L.), Spain http://www.ujaen.es/investiga/mascil University of Vienna, Austria http://mascil.science-edu.at Vilnius University, Lithuania http://ims.mii.lt/mascil

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	The University of Nottingham, Great Britain http://www.nottingham.ac.uk/research/groups/crme/projects/mascil.aspx National and Kapodistrian University of Athens, Greece http://noether.math.uoa.gr/mascil Foundation for Research and Technology Hellas, Greece http://noether.math.uoa.gr/mascil University of Münster, Germany http://mascil.ph-freiburg.de EDEX-Educational Excellence Corporation Limited, Cyprus http://www.mascil-cyprus.org/ Institute of Mathematics and Informatics at the Bulgarian Academy of Science, Bulgaria http://www.math.bas.bg/omi/mascil/index.html University of Kiel, Germany http://mascil.ph-freiburg.de
6. Description of the methods/ approach	The project employed inquiry-based learning (IBL) as the main method which is defined as being inductive, student-centered and focused on creativity and collaboration (Doorman, 2011). IBL aims to develop and foster inquiring minds and attitudes that are vital for students to face and manage uncertain futures and earning is driven by open questions and multiple-solution strategies.
7. Purpose/Aim	Mascil aims to promote a widespread use of inquiry-based science teaching (IBST) in primary and secondary schools. The major innovation of mascil is to connect IBST in school with the World of Work (WoW) making science more meaningful for young European students and motivating their interest in careers in science and technology.

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8. Evaluation (results) of its effectiveness (if applicable)	Read the report about the evaluation results: Report about the formative and the summative evaluation of the project https://mascil-project.ph-freiburg.de/research/evaluation.html
9. Overview of the lessons learned which are relevant to the project	Teachers PD https://mascil-project.ph-freiburg.de/professional-development.html Classroom material/ Repository: http://www.fisme.science.uu.nl/publicaties/subsets/mascil/
10. Web link	https://mascil-project.ph-freiburg.de/
11. References/ online sources	For publication visit https://mascil-project.ph-freiburg.de/contact.html Doorman, M. (2011). PRIMAS WP3 – Materials: Teaching and professional development materials for IBL (version 2). Netherlands.
12. Additional notes	Activities and Events: https://mascil-project.ph-freiburg.de/activities/activities-events.html

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Best Practice 6	
Topic/ Area	Science, Technology, Engineering, Arts & Maths
Title	Bebras Challenges (Ireland)
Type of Best Practice	Online Tools, Applications or Platform
Date released	Annual Irish Competition started 2012 (International Bebras challenge started in Lithuania in 2004)
Partners/ network	Irish Computer Society, Ireland (as part of the wider Bebras Community)
Description of the methods/ approach	Computational thinking involves using a set of problem-solving skills and techniques that software engineers use to write programs and apps. The Bebras challenge promotes problem solving skills and Informatics concepts including the ability to break down complex tasks into simpler components, algorithm design, pattern recognition, pattern generalisation and abstraction. The second week of November is declared as World-Wide BEBRAS week for solving tasks. Some countries extended it to two weeks. Many countries run all-year-round Bebras activities like participants

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	awarding events, second round of the challenge, summer campus, teacher workshops, collecting statistics and writing research papers. The Bebras challenges are made of a set of short problems called Bebras tasks and are delivered online. The tasks are fun, engaging and based on problems that computer scientists often meet and enjoy solving. The tasks can be solved without prior knowledge but instead require logical thinking. The aim is to solve as many as you can in the allotted time.
Purpose/Aim	Bebras is an international initiative aiming to promote Informatics (Computer Science, or Computing) and computational thinking among school students at all ages. Participants are usually supervised by teachers who may integrate the Bebras challenge in their teaching activities. The challenge is performed at schools using computers or mobile devices. We emphasise participation but also recognise top performing students. All countries provide different types of certificates available to students in each age group, for example, Certificate of Participation, Certification of Merit, Certificate of Distinction etc.
Evaluation (results) of its effectiveness (if applicable)	N/A
Overview of the lessons learned which are relevant to the project	The questions are in the form of engaging puzzles that start off relatively easy so every student can have a go and should get something out of the competition. There are 5 categories with different levels of difficulties: • Primary - Class 3rd and 4th (8-10 years old)

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	• Primary – Class 5th and 6th (10-12 years old) • Secondary – 1st and 2nd Year (12-14 years old) • Secondary – 3rd and 4th Year (14-16 years old) • Secondary – 5th and 6th Year (16-18 years old) The problems come in three levels of difficulty: Easy, Medium and Hard. Each level of difficulty consists of 5 questions.
Web link	https://bebras.techweek.ie/#split
References/ online sources	Bebras Community https://www.bebras.org/?q=join_us https://www.bebras.org/?q=goodtask
Additional notes	Students do not have to prepare or practice anything for the Challenge

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Best Practice 7	
Topic/ Area	Science, Technology, Engineering, Arts & Maths
Title	Irish Girl Guides Innovatively Engaging with STEM
Type of Best Practice	To inspire and guide the best in STEM education
Date released	June 2018
Partners/ network	Science Foundation Ireland / Irish Girl Guides
Description of the methods/ approach	Part of the remit of Science Foundation Ireland (SFI), through its SFI Discover Programme, is to inspire and guide the best in STEAM education and public engagement. Due to the nature of the organization the sessions will take place in informal settings and focus on younger females aged 7-10 years old.
Purpose/Aim	By encouraging younger girls to explore STEAM activities, it is hoped to encourage them to pursue STEAM subjects in school and to, perhaps, consider pursuing STEAM careers when they leave school. Research has shown that fewer females pursue careers in STEAM industries and that often they have made decisions before mainstream interventions. This approach introduces career potential earlier in a non-competitive environment.
Evaluation (results) of its effectiveness (if applicable)	N/A
Overview of the lessons learned which are relevant to the project	This is 1 of 41 wider initiatives being funded through the SFI Discover programme. It will stimulate important public conversations around scientific research and will highlight the individual, societal and economic value of

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	encouraging more people (young females in particular) in Ireland to explore science-related careers, earlier. This is intended to shine a light on Ireland as a hub for excellent research that is far-reaching and inclusive.
Web link	https://www.irishgirlguides.ie/innovatively-engaging-stem/ (2018)
References/ online sources	https://www.irishgirlguides.ie/ladybirds-mark-science-week-by-doing-new-stem-badge/
Additional notes	This and other projects are intended to pave the way for an innovative future.

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Best Practice 8	
Topic/ Area	Science, Technology, Engineering, Arts & Maths
Title	DCU - Learn it Academy
Type of Best Practice	Exploration of Science, Technology, Engineering and Maths and other subjects in new, fun and innovative ways that supplement and enhance young people's school education.
Date released	2009
Partners/ network	LEGO® Education, DCU, Learnit
Description of the methods/ approach	The only official partner of LEGO® Education in Ireland there are after-school classes, weekend workshops, summer camps, birthday parties and other events inside schools, colleges, libraries, homes and further education venues throughout the country. Workshops include: • Early Builders • Junior Robotics • Senior Robotics • Girl Power • Family Workshops

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	• Parents Playtime
Purpose/Aim	Through award-winning camps and workshops, young children not only gain a deeper understanding of STEM subjects, they also learn how to think creatively, solve problems and work as a team - all key skills which can be applied to other subjects and brought with them into adulthood. With an increasing demand for our services, we are taking our classes and camps to a growing number of venues throughout Ireland. See our Locations page to find the nearest one to you.
Evaluation (results) of its effectiveness (if applicable)	Since launching in 2009, Learnit as wider organization has delivered an expanding range of professional, hands-on, engaging workshops. 68,488 young people have participated • 3482 Workshops taken • 2886 School workshops delivered
Overview of the lessons learned which are relevant to the project	They also provide courses in Ireland's leading teacher training colleges and collaborate with other third level institutions through sister organization - STEM Solutions
Web link	https://www.learnit.ie/
References/ online sources	https://www.learnit.ie/stem-solutions https://www.learnit.ie/lego-education
Additional notes	https://www.learnit.ie/helpful-links - Join their Mailing List

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Best Practice 9	
Topic/ Area	Science, Technology, Engineering, Arts & Maths
Title	STEM Teacher Internship programme
Type of Best Practice	STEM Teacher Training
Date released	2015
Partners/ network	Dublin City University, Accenture, AIB, Alexion, Bank of Ireland, Ericsson, Gas Networks, Ervia - Irish Water, EY, Fidelity International, Fidelity Investment, GE, HPE, IBM, Intel, Microsoft, PWC, SSE Airtricity, Virgin Media, Vodafone, Xilinx.
Description of the methods/ approach	The STEM Teacher Internship programme aims to help young teachers educate future students about career paths in Science, Technology, Engineering & Maths. This is based on research that has found that teachers are key influencers of students' subject choices, second only to parents.

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	Through the internships 'pre-service' or 'newly graduated' STEM teachers will gain hands-on experience of the many careers and opportunities available within STEM industries directly in the companies in the sector.
Purpose/Aim	It is intended that this approach will help them to encourage participation by their own students, particularly female students, in STEM subjects. The programme provides opportunities for DCU 's primary and post-primary concurrent and consecutive teacher education programmes, including BSc Science Education, BSc Physical Education with Biology/Mathematics, B.Ed (Primary), Professional Masters in Education (PME) primary and post-primary.
Evaluation (results) of its effectiveness (if applicable)	"The importance of developing teachers' STEM competences cannot be emphasised enough, especially as teacher quality, not funding, is the determinant factor among conditions that support the performance of the world's best education systems." - Deirdre Butler, Professor, DCU Institute "I think the STEM internship is a huge opportunity for teachers, it gives us the chance to understand the wide variety of careers that subjects like science and maths offer. It has also highlighted to me skills that I can pass on in the classroom which can be of benefit to students who wish to pursue these careers." - Julie Robinson, BSc in Science Education 57+ DCU STEM teachers with a 12-week experience in 20 of Ireland's leading companies.
Overview of the lessons learned which are relevant to the project	The impact of this programme is such that it extends and deepens teachers' competences and knowledge of STEM and enhances the teaching and learning of STEM in their classrooms/schools."

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Web link	https://www.dcu.ie/news/news/2019/Apr/STEM-Teacher-Internship-programme-connects-teachers-and-industry-DCU.shtml (2019)
References/ online sources	https://www.dcu.ie/news/2017oct/s1017v.shtml (2018)
Additional notes	Paula Neary, Managing Director and STEM Sponsor, Accenture in Ireland said, "we have been conducting research into girls' participation in STEM since 2013. Our most recent report highlights the challenges that continue to exist in equipping teachers with the knowledge to inform younger females of the opportunities presented by a STEM career. As Ireland continues to position itself as the epicentre of the world's digital economy, we need to future proof the talent pipeline, so that half the population isn't excluded from the opportunities that STEM presents and to this end, industry has an important role to play."

Best Practice 10	 
1. Topic/ Area	STEAM for All, STEAM for Me, STEAM4U Toolkit & Stories
2. Title	**STEAM4U** - Raising students perceived self-efficacy in STEAM to provide opportunities for all
3. Type of Best Practice	☐ PD/ Training Programme

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	☒ Toolkit ☒ Online Tools, Applications or Platform ☒ Reports ☒ Handbook/ Guidelines ☐ Self-Assessment Test ☐ Other, please specify
4. Date released	13 Mar 2019 (the Artifact) & 21 Oct 2019 (the Strategies)
5. Partners/ network	1. Crecim-Universitat Autònoma de Barcelona 2. Carme Grimalt-Álvaro and Digna Couso, CRECIM – Centre for Research in Science and Mathematics Education.
6. Description of the methods/ approach	1. The belief and intuition that teens' empowerment and agency need to be tackled directly, as teens are a powerful and the most important actor in the educational scenario. 2. STEM stance is the way a person thinks about STEM-related activities (Science, Technology, Engineer and Mathematics), content, careers... especially expressed in a publicly stated opinion.
7. Purpose/Aim	1. Develop and offer to all stakeholders different tools and guidelines for the promotion of self-efficacy in STEAM. 2. Improve existing educational strategies -in current formal and non-formal learning environments- that promote the improvement of self-efficacy in STEAM for all students aged from 10 to 14 years old.
8. Evaluation (results) of its effectiveness	N/A
9. Overview of the lessons learned which are relevant to the project	Self-efficacy beliefs are difficult to modify, but not impossible. The STEAM4U project have undertaken different actions to raise 10-14-year-old teens self-efficacy both in formal and non-formal educational environments,

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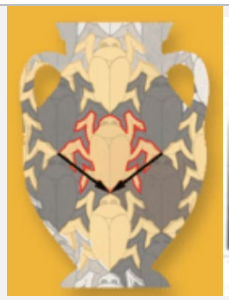
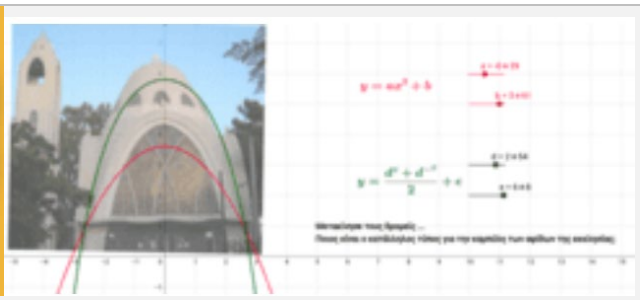
	and have identified and grouped several strategies with promising results
10. Web link	https://steam4u.eu
11. References/online sources	1. Artifacts addressed to 10-14-year-old teens https://steam4u.eu/homepage/steam4u-on-line-guide/artifacts-addressed-to-10-14-year-old-teens 2. STEAM is for ALL - The role of self-efficacy in STEAM https://steam4u.eu/homepage/steam-is-for-all/
12. Additional notes	According to the project partners, although there is a strong consensus in the field that self-efficacy beliefs can positively act in the stance on STEM of young people, there are few references about how to raise it in 10-14 year-old students.

Best Practice 11	 
1. Topic/ Area	Friezes, Pavings, Escher, Platonic Solids, Historical Data
2. Title	Math & Art in Athens
3. Type of Best Practice	☐ PD/ Training Programme ☐ Toolkit ☒ Online Tools, Applications or Platform ☐ Reports ☒ Handbook/ Guidelines ☐ Self-Assessment Test ☐ Other, please specify
4. Date released	2017-18
5. Partners/ network	Doukas School teachers and students (ages 14-16)
6. Description of the methods/ approach	Students and teachers of Doukas School visited museums, churches and monuments in the city of Athens. They focused on details of sculpture, table, mosaic and decorative elements and observed the paving in the building, the temple, the stained glass windows, the draft railings. They discussed about the way all the above were developed and combined by the artists and the architects;
7. Purpose/Aim	Design of a unique application using Google maps and Geogebra, to present areas with specific artwork. In this way we are able to show the mathematical background of the analysis, reproduction - application, similar works – exhibits and further historical data about the art and the artist.

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8. Evaluation (results) of its effectiveness	N/A
9. Overview of the lessons learned which are relevant to the project	During the implementation of the project, students recognized specific mathematical objects behind all of these structures, they explored their properties they study the way in which famous mathematicians dealt with all these objects in the past, they reproduce them using the appropriate software (GeoGebra) and they presented their results and conclusions
10. Web link	https://www.geogebra.org/m/NvUk8RTC
11. References/online sources	Greek Version: https://www.geogebra.org/m/Rjepeevs
12. Additional notes	As the project involved students from different classes, four groups of students were formed that dealt with: - Belt symmetries - friezes, - Paving with the use of regular polygons, - Paving techniques through Escher's work, - Platonic solids - symmetry in space.

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Best Practice 12	Hypatia PROJECT
1. Topic/ Area	Communication of Science to youth in a gender inclusive way
2. Title	**Ypatia** – Expect Everything
3. Type of Best Practice	☐ PD/ Training Programme ☒ Toolkit ☐ Online Tools, Applications or Platform ☐ Reports ☐ Handbook/ Guidelines ☐ Self-Assessment Test ☐ Other, please specify
4. Date released	2018
5. Partners/ network	Hubs, led by 5 science centres and museums, are located in 14 European countries
6. Description of the methods/ approach	Hypatia offers an accessible, practical and ready-to-use digital collection of activities (modules) for teachers, informal learning organizations, researchers and industry. The modules focus on gender-inclusive ways of educating and communicating STEM, empowers teenagers and explores the range of skills that are needed for a great variety of STEM studies and careers open to young people. The modules are developed by science centres and tested by teenagers and

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	colleagues in other countries. In this way they are applicable internationally.
7. Purpose/Aim	Hypatia is an EU Horizon 2020 funded project that aims to develop a theoretical framework on gender inclusive STEM education and to produce, test and promote a Toolkit with practical solutions and modules The Toolkit is a of 19 activities aimed at teenagers. Each module is composed of guidelines specific for each activity, guidelines dedicated to the theme of gender inclusion and guidance for facilitators on how to on how to manage the group dynamics by implementing different facilitation strategies.
8. Evaluation (results) of its effectiveness	N/A
9. Overview of the lessons learned which are relevant to the project	A key element for good facilitation is the active involvement of the participants every time a concept or content is presented. Involvement means for example: considering participants' personal experience, building on their own point of view or prior knowledge, embedding continuously the contributions of the participants in the process. Facilitation takes practice, time and reflection! In order to transfer these concepts into practical situations - and thus to foster engagement, interaction and discussion there is a brief list of suggestions.
10. Web link	http://www.expecteverything.eu/hypatia http://www.expecteverything.eu/hypatia/toolkit/

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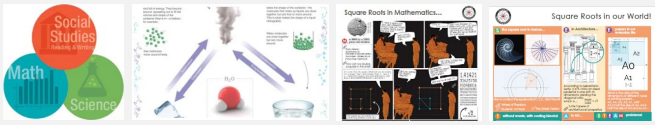
Best Practice 13	CollectEdNY resources for New York State educators 
1. Topic/ Area	Science-Technology-Engineering-Arts-Maths & Social Studies
2. Title	**Collections of Educational Infographics** (2 independent collections: CollectEdNY & E-I-STEAM)
3. Type of Best Practice	☐ PD/ Training Programme ☒ Toolkit ☒ Online Tools, Applications or Platform ☐ Reports ☐ Handbook/ Guidelines ☐ Self-Assessment Test ☐ Other, please specify
4. Date released	2017-2020
5. Partners/ network	1: NYS Teacher Leaders of CollectEdNY

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	2: Partners for the Educational Infographics for STEAM
6. Description of the methods/ approach	1: The Teacher Toolkit of the CollectEdNY provides background knowledge for teachers on what infographics are and why it makes sense to use them. There are explicit connections to the Next Generation Science Standards and the Common Core State Standards in the toolkit. 2: The Educational for Infographics STEAM project (E-I-STEAM) develops visual materials that will help students understand the challenging topics in their books.
7. Purpose/Aim	1: CollectEdNY has developed the Classroom Teacher Toolkit that employs infographics as a way "for students to practice key science literacy skills". While the focus of these lessons is science, this toolkit can be used as a how-to guide on infographics in any content area. 2: E-I-STEAM aims: - to create teaching methods through innovative approaches; - to engage students in STEAM activities; - to increase the level of knowledge in the key-competences; - to provide hands-on learning opportunities; - to promote internationalization and European values;
8. Evaluation (results) of its effectiveness	There is list generated by experts of the California Academy of Sciences about what makes a good infographic.
9. Overview of the lessons learned which are relevant to the project	When students interpret infographics, they practice reading and understanding graphs, charts, diagrams, and maps; finding patterns in data and interpreting their meaning; and arguing from evidence to support their interpretation of the infographic. When students critique others' infographics, they practice using evidence to support an argument. When students create their own infographics, they gain experience analyzing data, finding and explaining patterns in

	data, and thoughtfully deciding how to visually present that data.
10. Web link	CollectEdNY: https://www.collectedny.org/frameworkposts/collection-of-infographics E-I-STEAM: https://steam-edu.eu
11. References/ online sources	CUNY HSE Curriculum Framework: http://www.collectedny.org/2016/03/hseframework Infographics in the Classroom Teacher Toolkit: https://www.calacademy.org/educators/infographics-in-the-classroom-teacher-toolkit Unpublished Infographic for the E-I-STEAM project: https://www.dropbox.com/s/9lxer36acy0yyqd/Square-Roots-A3.pdf

Best Practice 14	SMART KIDS LAB
1. Topic/ Area	DIY science, citizen science for kids
2. Title	Smart Kids Lab
3. Type of Best Practice	• PD/ Training Programme • **Toolkit** • Online Tools, Applications or Platform • Reports

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	• **Handbook/ Guidelines** • Self-Assessment Test • Other, Community Art Project
4. Date released	2018
5. Partners/ network	Waag Society, Cinekid, RIVM, the Netherlands
6. Description of the methods/ approach	How clean is the air you breathe? Is swimming water the same as drinking water? How many microbes live in the soil beneath your feet? And what does it all mean? HOW DOES IT WORK? Choose your topic MAKE YOUR METER and get going in your own neighbourhood.
7. Purpose/Aim	With Smart Kids Lab children can explore water, sound, air, earth and light with homemade measuring instruments. It enables children to map out and interpret their immediate environment at home and at school by means of experiments with the homemade sensors. In this way they playfully come into contact with the possibilities of technology and science.
8. Evaluation (results) of its effectiveness (if applicable)	N/A
9. Overview of the lessons learned which are relevant to the project	N/A
10. Web link	http://smartkidslab.nl/english
11. References/ online sources	Smart Kids Lab has been developed in collaboration with Cinekid and RIVM and has been realized with contributions from the Foundation for Culture and Education and the Horizon 2020 research and innovation programme of the EU. The project is part of a European programme: MAKING SENSE.

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Best Practice 15	
1. Topic/ Area	Science
2. Title	ROOTS: Ik ben Science A community-based, multilingual STEAM program
3. Type of Best Practice	• PD/**Training** programme • Toolkit • Online Tools, Applications or Platform • Reports • Handbook/ Guidelines • Self-Assessment Test • Other, please specify
4. Date released	8 Feb - 20 June 2020
5. Partners/ network	a) Name of the partner b) Country of origin c) Role in the practice a) Institute of Science Education and Communication at the Faculty of Science and Engineering, University of Groningen b) The Netherlands c) Organiser
6. Description of the methods/ approach	ROOTS is an after-school community program which offers a space where families, educators, visiting scientists and artists come to work together on science investigations. It offers the residents of Beijum and neighbouring districts opportunities to engage in science-related activities on Saturday mornings. ROOTS is used to refer to the urgency of communities moving towards a more

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	environmentally sustainable future. “Ik ben Science” is used to refer to the programme’s aspiration to increase students’ self-identification with science, or put simply, seeing themselves as science persons. The activities are not only related to science but incorporate technology, engineering, environmental sciences, the arts and mathematics. The programme aims to offer a space where families, educators, visiting scientists and artists come to work together on science investigations. We envision that a diverse group of persons will find the space welcoming and embrace the practice of science as something within their reach and abilities.
7. Purpose/Aim	The program aims to engage young children living in underprivileged and ethnically diverse communities in science investigations rooted within problems situated in their local contexts, e.g. explorations of the environmental and social implications of earthquakes. It aims for these children to gain an interest in science and consider careers in science, while at the same time helping migrant children and their families connect with their local communities.
8. Evaluation (results) of its effectiveness (if applicable)	The program is still ongoing, so no evaluation yet. However, the Open Day on Feb. 8 th was the first of the 20-week programme that is open to 8-13 year olds On the first day, we had about 50 people packed into the Grand Theatre room of the Trefpunt centre, engaging with attractions such as the blender bikes where you ride the bicycles to make your own smoothie and kitchen science with slime. The feedback has been wonderful with the kids inviting their friends to join them in following sessions.

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9. Overview of the lessons learned which are relevant to the project	1. Professional development of the trainers is important in order to support them in developing a shared understanding of STEAM as a set of integrated activities across the different disciplines instead of compartmentalized activities situated in distinct activities. 2. The arts and especially the role of creativity across the STEM fields needs to be addressed explicitly. While ARTS is easy to incorporate in lessons its relevance and value is not directly recognized by the participants.
10. Web link	http://www.rootsikbenscience.com/ https://www.rug.nl/sciencelinx/maatschappij/roots_-i-am-science_
11. References/ online sources	• 6 shorts videos demonstrating experiments • 12 Videos and more than 300 images of parents and children engaging in investigations • Student work (photovoice, drawings etc.)

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Best Practice 16	 
1. Topic/ Area	Science/neurobiology
2. Title	Community Art project with crafted neurons at science festival, organised by Science LinX/University of Groningen
3. Type of Best Practice	• PD/ Training Programme • Toolkit • Online Tools, Applications or Platform • Reports • Handbook/ Guidelines • Self-Assessment Test • Other, Community Art Project
4. Date released	April 2019 - 8th of June 2019 (Science Festival)
5. Partners/ network	University of Groningen, Netherlands, organiser science festival Night of Art and Science, together with local partners

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	Neural Knitworks; Australia; providing pattern book and support/advice (see 11 below) Yarn shop 'Achterpand'; Netherlands; providing materials, network of crafters, get-togethers Neurobiologist University of Groningen; Netherlands; providing content to the workshops
6. Description of the methods/ approach	In June 2019, the science festival Night of Art and Science took place in the city of Groningen, The Netherlands, with the theme 'Inclusion'. Giving this theme, our aim was to involve the public in making a Community Art project, showcasing the result during the science festival. Neurobiologists at our faculty of Science and Engineering came up with the Neural Knitwork (see online source below) as a project. Planning project with a team of neurobiologists and science communicators (aim, timeline, events) + patterns provided by Neural Knitworks PR (social media, flyers, website of science festival, interview with local newspaper) to announce the Community Art Project. Organise events: - get-togethers at yarn shop to craft neurons - lessons at schools by neuron biologist explaining use of neurons and crafting them - stand at craft market with flyers and materials to get the community involved Science festival: We managed to get 270 neurons (our aim was 200). Selected on color, we hang them in a tree shaped structure at a prominent place at the festival. Neurobiologists were present to inform the public about the use of neurons, and the project.

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7. Purpose/Aim	The aim was: 1) to get groups of the public involved that normally would not participate in science 2) to teach the public about what neurons are and how important they are for our functioning, while crafting them.
8. Evaluation (results) of its effectiveness (if applicable)	N/A
9. Overview of the lessons learned which are relevant to the project	- it's a great way to get young and old people involved that normally would not participate that easily in science - Good to include a yarn shop as partner in the project, facilitating get-togethers, providing materials and using their network. - The patterns of neurons had different levels, from very easy (winding) to more difficult (knitting or crochet), so both inexperience and very experienced people could contribute and make a neuron to their personal liking - It's a nice method to get school children involved in science. They learn about the function of neurons, while crafting them. They are really proud of their work and wanted to share the results with others. We organised a special event during the daytime (as the festival started in the evening) for children to come and have a look at their neurons in the art work. They were really enthusiastic about seeing their own neuron. After the science festival, all neurons return to the children who made them.

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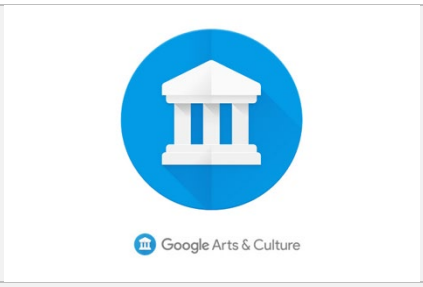
	- Two months was relatively short for organising such a community art project.
10. Web link	N/A
11. References/ online sources	*Neural knitworks:* https://www.scienceweek.net.au/neural-knitworks/ ** If you wish to host a Neural Knitwork event outside of Australia's National Science Week or the Cambridge Science Festival we ask that you make contact to seek permission to use the material.* https://nachtvankunstenwetenschap.nl/acts/community-art-neural-knitworks/

Best Practice 17	
1. Topic/ Area	Arts
2. Title	Google Arts and Culture: Experience culture in 360º
3. Type of Best Practice	Online Tools, Applications or Platform
4. Date released	N/A
5. Partners/ network	Google
6. Description of the methods/ approach	The teacher can support his or her theoretical classes with a series of 360º resources, creating an immersive experience and the possibility of seeing the concepts analysed in the theoretical class from the inside. The students can also use these resources in a particular way, increasing their

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	motivation and interest in the topics covered in these resources.
7. Purpose/Aim	To bring cultural spaces, performances or places that generally cannot be visited closer to the public of all ages in an interactive way
8. Evaluation (results) of its effectiveness (if applicable)	N/A
9. Overview of the lessons learned which are relevant to the project	Experience culture at 360º, not only art galleries but also architectural jewels, cultural centers and other spaces such as a space shuttle or fashion shows
10. Web link	https://artsandculture.google.com/project/360-videos
11. References/ online sources	Opéra National de Paris: https://g.co/arts/f2h8JDh669ZzuR6g9 Bruegel, A Fall with the Rebel Angels: https://g.co/arts/ZeAjeqc89j6wj3NY6 British Fashion Icons in 360º: https://g.co/arts/gUDdv7FAvLn8sQ118

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Best Practice 18	codecademy
1.Topic/ Area	HTML language
2.Title	Codecademy
3.Type of Best Practice	Online Tools, Applications or Platform
4.Date released	N/A
5.Partners/ network	N/A
6.Description of the methods/ approach	The resources and different online courses contained in the webpage could be used in the Flipped Classroom methodology. Students will watch the different videos and complete the different courses at home before working on more specific aspects related to them in the classroom.
7.Purpose/Aim	The purpose of the use of these elements is the acquisition of knowledge related to the creation of websites using HTML language.
8.Evaluation (results) of its effectiveness (if applicable)	This acquisition of knowledge could be evaluated through a list of compulsory elements that should appear in the website created by the students.
9.Overview of the lessons learned which are relevant to the project	The different lessons will consist on the creation of a webpage. By working in groups, students will be able to put the knowledge acquired before into practice.
10.Web link	https://www.codecademy.com/learn/learn-html
11.References/ online sources	https://www.codecademy.com/learn/learn-html

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Best Practice 19	
1.Topic/ Area	Programming
2.Title	Scratch
3.Type of Best Practice	Online Tools, Applications or Platform
4. Date released	N/A
5. Partners/ network	N/A
6. Description of the methods/ approach	The teacher will explain the students the theory about programming by using the resource in class with them, showing students how to use the different commands. Once they learn the basic contents of programming, students will have to face different templates so they will progressively acquire greater abilities in this area.
7. Purpose/Aim	Students will learn how to basically program using Scratch, an online easy-to-use tool for that purpose.
8. Evaluation (results) of its effectiveness (if applicable)	Students will work on different templates that will follow a difficulty path, so the first one will be the easiest and the last one the most difficult one. This way, evaluation will be simultaneous as students will have to start a new template once they finished the previous one.
9. Overview of the lessons learned which are relevant to the project	These resources and videos will enable students acquire a basic knowledge of programming using Scratch.
10. Web link	https://scratch.mit.edu/projects/editor/?tutorial=getStarted

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Best Practice 20	
1.Topic/ Area	Programming
2.Title	Create your own videogame using Scratch
3.Type of Best Practice	Online Tools, Applications or Platform
4.Date released	N/A
5.Partners/ network	N/A
6.Description of the methods/ approach	Flipped classroom can be used in order to let students acquire the different contents following their own pace. Students will watch the different videos outside school and work on their videogames in class. If needed, teachers will provide different explanations using digital blackboards and projectors.
7.Purpose/Aim	Students will learn how to program and acquire basic contents of programming in order to create their own videogame.
8.Evaluation (results) of its effectiveness (if applicable)	Teachers could give simultaneous feedback to students in order to improve their videogames and correct different mistakes. Moreover, we could give students the chance to try their classmates' videogames and provide peer feedback.
9.Overview of the lessons learned which are relevant to the project	These resources and videos will enable students acquire a wide knowledge of programming using Scratch.
10.Web link	https://scratch.mit.edu/
11.References/ online sources	https://www.youtube.com/watch?v=PfQiTBbHHY4 https://www.youtube.com/watch?v=IkzUx_VTnLg

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	https://www.youtube.com/watch?v=6bopWxYR0g4 https://www.youtube.com/watch?v=Hqm2fE41Ci8

Best Practice 21	
Topic	Resources for Teachers of all STEAM subjects across all Primary & Secondary age groups - Website and compendium of teaching resources
Title	TES
Duration	N/A
Lead Partner	N/A
Partners/ network	N/A
Web link	https://www.tes.com/
Relevant documents or outputs	https://www.tes.com/teaching-resources/steam https://www.tes.com/teaching-resources/blog/scientific-explorations-eyfs - a selection of ideas and resources aimed at early years learners https://www.tes.com/teaching-resources/blog/inspirational-steam-ideas-primary - a selection of ideas and resources aimed at the primary level students https://www.tes.com/teaching-resources/blog/popular-steam-projects-secondary - a selection of ideas and resources aimed at secondary level students
Description	Tes is a global educational organisation working with 25,000 schools in over 100 countries. They provide

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	recruitment support for schools and information, advice and guidance to teachers and school leaders. They provide access to a wide range of teacher made resources across all national curricular subjects
Methodology	Teacher made resources available via website and printable documents. The majority of the resources are OERs, but some require a subscription to access or a small one off charge
Output Benefits	Thousands of OERs for teachers of primary and secondary level. Professional development and peer support opportunities
RISKS	N/A
Workable – Transferable practices	https://www.tes.com/teaching-resources/blog/putting-a-steam-lessons
References	N/A
Additional notes	N/A

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Best Practice 22	
Topic	Resources for Teachers of all STEAM subjects across all Primary & Secondary age groups - Website and compendium of teaching resources
Title	STEM Learning
Duration	N/A
Lead Partner	N/A
Partners/ network	N/A
Web link	https://www.stem.org.uk
Relevant documents or outputs	https://www.stem.org.uk/resources https://www.stem.org.uk/resources/curated-collections/primary-0 - primary level resources https://www.stem.org.uk/resources/curated-collections/secondary-and-level-design-and-technology-0 - secondary level DT resources https://www.stem.org.uk/resources/curated-collections/secondary-and-level-mathematics-0 - secondary level Math resources

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	https://www.stem.org.uk/resources/curated-collections/secondary-and-level-science-0 - secondary level Science resources https://www.stem.org.uk/resources/curated-collections/secondary-and-level-computing-0 - secondary level Computing resources
Description	STEM Learning is the largest provider of education and careers support in science, technology, engineering and mathematics (STEM) within the UK. They are supported by a unique partnership of Government, charitable trusts and employers, and are dedicated to raising young people's engagement and achievement in STEM subjects and careers
Methodology	Online community of teachers and educators providing OERs. Teacher created resources that are free-to-access and quality assured. Opportunity to share your own resources for other to access
Output Benefits	Thousands of OERs for teachers of primary and secondary level. Professional development and peer support opportunities
RISKS	N/A
Workable – Transferable practices	https://www.stem.org.uk/stem-clubs https://www.stem.org.uk/enrichment https://www.stem.org.uk/resources/curated-collections/using-space-context-0
References	N/A
Additional notes	N/A

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Best Practice 23	Resilient Educator
Topic	Information, advice and guidance for educators
Title	Resilient Educator
Duration	N/A
Lead Partner	N/A
Partners/ network	N/A
Web link	https://resilienteducator.com/
Relevant documents or outputs	https://resilienteducator.com/collections/steam-teaching-resources/ - tips, support and resources for the STEAM subjects including practical activities and classroom based projects https://resilienteducator.com/collections/math-teaching/ - tips, support and resources for Math covering all educational levels
Description	Resilient Educator is a website to support the personal and professional development of educators. It provides a range of information, advice and guidance to teachers including classroom resources and toolkits.
Methodology	Online compendium of resources and sign-posting
Output Benefits	Personal and professional support for educators
RISKS	N/A

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Workable – Transferable practices	https://resilienteducator.com/collections/integrating-technology-in-classrooms/ https://resilienteducator.com/collections/downloadables/

Best Practice 24	
Topic	Coding and programming
Title	BBC micro:bit Educational Foundation
Duration	N/A
Lead Partner	N/A
Partners/ network	ARM, BBC, British Council, The Institution of Engineering and Technology, Lancaster University, Microsoft and NOMINET
Web link	https://microbit.org/
Relevant documents or outputs	https://microbit.org/get-started/first-steps/set-up/ - how to set up a micro:bit device https://microbit.org/get-started/user-guide/overview/ - user guide to the features and specifications of the micro:bit https://microbit.org/get-started/bbc-microbit-in-school/ - how to best utilise the micro:bit in the classroom https://microbit.org/get-started/home-learning/ - easy-to-follow activities for students to conduct at home https://microbit.org/lessons/ - free-to-use lesson plans that utilise the micro:bit computers as part of a structured activities

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Description	BBC micro:bit Educational Foundation is a UK based not for profit organisation aimed at inspiring children to participate in the digital world. The micro:bit itself is a tiny computer that makes coding tangible and promotes digital creativity.
Methodology	The organisation provides the micro:bit computers to schools or individuals and the website provides support and guidance for using them as a teaching/learning resource
Output Benefits	Hands-on practical resource to help students learn coding and programming skills
RISKS	N/A
Workable – Transferable practices	https://microbit.org/projects/ https://microbit.org/code/

Best Practice 25	
1.Topic/ Area	Science
2.Title	Science For Fun
3.Type of Best Practice	EU Project
4.Date released	2018
5.Partners/ network	1. Pro Work - The Netherlands 2. Universidad Autónoma de Madrid – Spain 3. University of Humanities and Economics in Lodz – Poland 4. Fundación Siglo22 – Spain 5. JKVG vzw – Belgium 6. Sociedade Portuguesa de Inovacao – Portugal 7. Natsionalen ucheben tsentar – Bulgaria

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	8. Ljudska univerza Velenje – Slovenia 9. Euroface Consultign s.r.o. - Czech Repulic
6.Description of the methods/ approach	In Service of e-training programs for Science Teachers. The project developed an online learning environment for science teachers with tools and learning modules.
7.Purpose/Aim	The subject of the project is to create an attractive and effective way of teaching science by an innovative model. One of the aims of the project is also to assess the evolution of science learning through the course of the project and explore the possibilities of big data analysis to help develop interesting and methodological innovative scientific curricula.
8.Evaluation (results) of its effectiveness (if applicable)	As a result of the project, a series of modules have been developed that can be used by teachers in their classes, in different languages and adapted to different European countries. Once the project is finished, the partners will evaluate the impact and results of the project.
9.Overview of the lessons learned which are relevant to the project	Any of the modules developed by the Science4Fun project is relevant to this project.
10. Web link	https://www.science4fun.eu/

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