MakeAppClub

Digital Makerspace **Toolkit**

ESTedu pl

Erasmus+

Wavemaker

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The Digital Makerspace Toolkit was written by the Make App Club team, including Aleksander Schejbal, Lukasz Putyra, Benedict McManus, Alex Rowley, Chris Davis, Sean Dissington, Mary Fletcher, Kathy Jackson, and others.

“Change in the world always begins with an individual who shares what he or she has learned and passes it on to others”

- Dalai Lama

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Introduction

MakeApp Club is an Erasmus+ youth project in which two organisations (one from the UK and one from Poland) teamed up to organise collaborative digital making activities for young people. Wavemaker, from Stoke-on-Trent, already had a digital makerspace at the time of launching their project whilst EST, from Wadowice, needed to set one up to provide a learning environment, where they could engage young people in digital creativity. From the very beginning, it was an exciting learning experience for Wavemaker staff having been given the chance to share approaches, youth engagement strategies and technical expertise.

After more than one year into the MakeApp project, we feel we are now at a point where we can share some of our journey and knowledge with other like-minded people. We hope that this toolkit will support those who are interested in setting up their own makerspace to enhance skills within their community.

This toolkit is designed to be the resource that we wished we'd had available to us when we were starting our makerspaces in Stoke and Wadowice. It covers some of the things that we learnt on the job: like what resources we needed, the most effective strategies for working with young people, and who you can contact to help you to get started.

The toolkit is aimed at helping enthusiasts, teachers, youth workers and volunteers to run small clubs, makerspaces and workshops. We want to enable the creation of a learning environment rich with possibilities, allowing anyone to expand their science, technology, engineering, arts, and maths (STEAM) skills through experimenting, tinkering and making.

Such STEAM skills are of ever growing importance and embody the world around us. Yet despite this, according to the 2015 Nesta 'Young Digital Makers' report, 'In the UK there is currently a lack of skills in making with technology, with the recent House of Lords report on digital skills warning that change is so rapid, the UK could be left behind in terms of our digital capabilities' (p.8). A similar challenge in Poland led to a recent initiative by the Ministry of Administration and Digitisation, in cooperation with a wide range of education and business stakeholders, to foster development of digital skills through actions promoting their inclusion at all levels of education, efficient use of digital technology and acceptance of changes caused by its sustainable development (http://umiejetnoscicyfrowe.pl).

Positively, the research behind these reports and initiatives also considered that much is already being done to combat the digital divide in our countries. Computer Science has recently been introduced to the National Curriculum in the UK and the new education reform in Poland argues for cross-curricular learning of digital skills. Furthermore, such structural reforms in our countries have been complimented by actions supporting extracurricular digital activities for young people: e.g. the Barclays' Digital Eagles Programme and Samsung's Digital Academies in the UK, or Orange digital workshops in Poland, followed by many grassroots organisations that support digital making.

This is where we come in. Small scale local makerspaces have a huge part to play in helping to develop the skills and aspirations of the digital makers of the future. See how we made our journeys towards these goals.

The Wavemaker Journey

Wavemaker was established as a non-profit organisation in June 2015. We have been lucky enough to be supported during the initial three years of our journey through £300,000 worth of funding from the Robbie Williams' Give it Sum Fund (managed by Comic Relief) and the Nominate Trust. This meant that we had funding in place to purchase resources, rent space and hire staff.

However, before the scheme was given the go ahead, a six month feasibility study took place to see if the Wavemaker project would meet local needs as well as funding requirements. The feasibility study involved travelling around the country to look at other Fab-Labs and makerspaces to see what worked and what didn't. It also considered whether there was an appetite for the space amongst local schools, the community and businesses.

Since then, we have become the leading makerspace in Stoke-on-Trent, where people can come together with professionals to make, play, learn and grow. Our mission is to inspire, educate and support learners, makers, artists and entrepreneurs, and in turn grow communities and businesses in the city of Stoke-on-Trent and beyond.

By developing exciting learning materials and creative projects, we offer a fun and valuable experience for all members of the community whilst allowing everyone to come together in a cohesive way.

Our four core areas of focus are to:

- work with schools and organisations through our STEAM programme, teaching new skills and inspiring the next generation.
- provide access to a variety of making and prototyping tools and equipment, such as laser cutters and 3D printers.
- host classes, talks and meetups, to inspire, teach and connect people from all backgrounds.
- work with businesses, providing our services and creating links for growth and education.

We work hard to create opportunities to enable and empower people in digital making.

The EST Journey

Foundation EST was established in March 2015 so their journey began almost at the same time as Wavemaker's. However, the beginnings were very different. The foundation was set up within an education establishment with a long record of extracurricular activities addressed to young people in the community. We could therefore rely on a wealth of experience in engaging youngsters in after-school learning even though the prospect of creating a digital makerspace came as a completely new offer. We could also benefit from the availability of a workshop room with basic furniture and media for which we didn't have to pay.

Nevertheless, all the other things need to be organised from scratch. The old computers we received from a previous ECDL centre were much below the standard one could expect in a modern digital makerspace. Similarly, the desks and chairs left over from a previous seminar room didn't really fit the purpose of creating a comfortable, youth-oriented environment. We had to look for resources to gradually change the image of the space and its technical infrastructure. We used funds from different sources - a portion of the Erasmus+ grant could be used to purchase Raspberry Pis and laptops and we also secured support of private sponsors to buy two new computers and some new chairs and tables. A new 3D printer, which comes with a whole education ecosystem from Scriware, was acquired through our participation in a parallel project focused on 3D design. Finally, we put a lot of effort into arranging the space, making it more colorful with large photos from our youth projects displayed on the walls.

Halfway through the MakeApp Club project, we are thus fully operational as a small digital makerspace with a small group of young makers coming to work and learn with us. Our ambition is to consolidate this achievement and set it firmly in our community. To this end we currently focus on:

- Connecting all our initiatives addressed to young people into a coherent programme tapping into their authentic interests in digital media
- Using these media to leverage young people's learning and progression to meaningful jobs
- Building bridges with local organisations working with youth to be able to better communicate our mission in the community
- Strengthening our involvement in European projects which have already substantially helped us develop our potential in terms of knowledge, social networks and technical capacity

We will share experiences from both our journeys throughout the toolkit to exemplify different ways towards the same goal of fostering youth's digital creativity.

What is a digital makerspace and digital making?

Digital skills, digital literacies, digital creativity; there are many terms used by different people in different ways in this area. We have been emphasising digital making as distinct from simply using digital devices, and as the best way of understanding how technology works. Our work to date has focused on helping young people to understand the fundamentals of the technology they're using while they are making.

Digital makerspaces are a physical place where people (young and old) can come together to create, share, learn and develop, following in a long tradition of learning through making. It is a space that offers tools for creation, and can be anywhere you see fit; a library, school, community centre, garage, or even the living room floor!

For us, it was paramount that the space was one that was inviting, open, safe and accessible. This helps to create the kind of creative and relaxed environment where people can experiment and play. A place where people can try and try again in a constructive environment. After all, when Thomas Edison was asked how it felt to fail 1,000 times in inventing the lightbulb he replied that, 'I didn't fail 1,000 times. The light bulb was an invention with 1,000 steps'.

Sharing and collaboration is also really important. This includes both sharing ideas and resources with each other as well as sharing common interests and goals. A makerspace is a place where professionals, young people and makers can mix.

Helping young people and members of the community to develop STEAM skills should also be at the heart of a makerspace. Making is innovative and resourceful. Makers build off the ideas of others and choose the best tools for the job, whilst identifying their own challenges and solutions.

The digital skills being developed can be really diverse, including: programming, design, 2D and 3D design, photography, film, programming, and sound/music creation, as well as prototyping and invention. Making provides many opportunities to understand difficult concepts.

What impact can a makerspace have?

Educational

Not bound by the national curricula in our countries, makerspaces allow for an environment where learners can experiment and play with technology - figuring out new things and gaining new skills. Furthermore, making is innovative and resourceful. Makers build off the ideas of others and choose the best tools for the job, leading to a greater understanding. Learners can be inspired - leading to new discoveries and opportunities. A particular interest could determine a new career path, or a prototyped product could lead to a new invention.

Economic

Makerspaces have the potential to make a positive impact within your local economy because digital skills are increasingly in demand and, in many areas, there is a digital deficit ie lack of access to technology and associated learning. By making young people with digital skills attractive to companies, they have the chance to grow and can give them the confidence to stay in a particular area.

Digital inclusion

Young people and community members that have strong digital skills are more likely to be able to access the services that they need online: such as booking GP appointments, accessing their personal tax account, shopping online, finding out their bank balance and researching new employment opportunities. This saves individuals time and money and would also save money for the NHS and Local Authorities.

Wellbeing & Health

Makerspaces provide a safe and accessible space where young people and community members can come to meet new people and to learn new skills. This helps to prevent loneliness and provides a space outside of school where young people can have a positive social and educational experience. This is particularly important for young people who come from disadvantaged backgrounds, who are being bullied or do not excel in a traditional school setting.

What is the ideal size and scope of a makerspace?

Makerspaces can come in all shapes and sizes. There is no one size fits all model. What's more important, is that your makerspace meets the needs of your community and the amount of time and energy that you have to devote to it.

We want this toolkit to be useful to you, whether you are setting up a community makerspace, an after school club or a one-off workshop or conference.
Throughout the toolkit we will give hints and tips that are suitable for makerspaces, clubs and workshops of different sizes and at different stages in their development.

After School Clubs/ College Clubs

After school clubs might meet once a week or fortnightly in a classroom within a school or college. They generally need to cater for a range of ability types and ages. They can work in two ways: 1) All participants work together on the same project during each half term or term. 2) Participants are free to pick their own project and are supported to do this by a teacher or leader. The first model can work well for leaders who have less knowledge of STEAM and enables them to learn alongside the young people that they are working with.

Workshops

Workshops can be a great way to build up an appetite for digital making within your area and can last as little as one or two hours. They usually focus upon one skill or task that can be completed within the time frame. They also provide an opportunity to experiment with different tasks and teaching methods. If a particular task doesn't work well, you have a fresh start to try something new at your next workshop. They usually cater for school groups where all of the participants will be roughly the same age. This means that less differentiation will be needed.

If you already run a successful makerspace or after school club, you might want to start thinking about running a workshop to help to get more local people into digital making. This can even be a group project that will help develop interpersonal, organisational and enterprise skills.

Conferences

Conferences work well when you have already built up a range of contacts with businesses, digital organisations and community partners within your area. They often last from one to three days and offer an opportunity to showcase the work that you are doing, to learn about the latest developments within the STEAM sector and to network.

Organising a conference can be a significant time commitment, so it is often best to partner up with another organisation to deliver the conference. Administration, advertising and logistics can then be shared - reducing costs and workload.

Outline of toolkit content

The toolkit is designed to be a resource that you can either read at length or dip in and out of.

Chapter One looks at insights into how makerspaces are run and equipped. It will look at some of the things that you might want to consider before starting a club, what support and resources you might need, what makes a good location and space, and how you can make your makerspace sustainable.

Chapter Two considers effective methods of engaging young people in collaborative making with technology. This includes detailing youth work strategies which have already developed small communities of practice for developing digital skills.

Chapter Three details the activities that we have found to attract the most interest from young people such as simple app making, web coding and game modelling. It also considers how young people relate to the development of their technical, social and employability skills.

In **Chapter Four** we share online support tools with you that you can use to facilitate the running of workshops and clubs. These tools are available free of charge and can be used by tech professionals and non-professionals alike. Being well-connected to like-minded professionals, groups and enthusiasts will make the start of your journey to running your own digital makerspace or club much easier. In this chapter, we also share a list of contacts that can be approached for advice and who are willing to share good practice with newcomers to the field. Such support is essential in the initial stage of development.

MakeAppClub

Chapter One:

Insights into how digital makerspaces are organised and equipped

EST.edu.pl

Erasmus+

Wavemaker

Chapter One: Insights into how digital makerspaces are organised and equipped

Some things to think about before starting your club

You may know that it's important for local young people and members of the community to develop digital skills. Or you may be a professional working in the tech sector that's looking to pass on their skills. So, you have the idea to start a digital maker space within your area, but where do you go next?

The first (and one of the most beneficial) things that we recommend that you do, is invest some time in research and development. This might sound a bit scary but what it really means is checking whether any other provision already exists and finding out whether there is need for your club or workshop:

- Check what other people in your local area are doing. Do any other makerspaces exist? If they do, is this something that you can get involved in, or is it far enough away to justify a new space?
- Has a makerspace already been tried in your area? If it failed, what were some of the reasons that this happened? Is this something that can be overcome? It might also be worth having a chat with the person/people that tried setting up a club before – they might be interested in working with you.
- Is there already an identified need for a club?
- If you don't know if there is an interest in your area then taster sessions are a great way to gauge interest in schools, youth clubs and with members of the public.
- You can also interview teachers and parents about what the needs of young people within the area are.
- Our top tip is not to second guess what other people might want. If you try something and it doesn't work, don't be afraid to try something different.

People

Once you have done some research and concluded that that there is a need for a digital makerspace, you might start asking yourself:

1. Do I have the right skills?
2. Can I run a club by myself or do I need to recruit other people to help me?

It is our belief that any youth worker, teacher or enthusiast can set up a digital maker club, even if they do not have any tech skills. However, the level of skills the club leader possesses does have an impact upon the kinds of activities that your club delivers. Depending on the size of your club, there may be the need for more than one member of staff / leader. Below are a list of skills and attributes which are of benefit to anyone running a makerspace or club.

General skills and attributes:

- Drive to help young people build skills and confidence
- Engage in own learning and exploration
- Enjoy meeting new people and sharing ideas
- Work with project groups to help them achieve their project visions.
- Help learners to acquire skills with tools, tool safety, and other aspects of hands-on fabrication.
- Track use of consumable materials, re-order as needed.
- Ability to run safety training for all who use the makerspace; monitor that safety is practiced at all times.
- Ability to lead workshop session
- Good level of digital awareness

Tech and Maker Skills

- 2D Design and software knowledge
- 3D Design
- Graphics design
- Web design
- Understanding of programming languages and principles.
- Knowledge of programming languages the ability to code
- Electronics
- Video Editing and software applications
- Sound production
- Good with hands, fault finding, and tackling problems
- Wood working
- Metal Working

People

It is completely possible to run a makerspace, club or one-off event by yourself. However, asking more people to help will expand the range of activities that you are able to offer and will take the pressure off.

How collaborators can help to develop your makerspace:

- Working with someone else who has a different STEAM skill set to you can broaden the range of activities and workshops that you are able to offer.
- Another person may be able to take on some of the advertising and administration burden for your makerspace.
- They may be able to offer a soundboard for new ideas. And, they may in turn have their own ideas for developing the makerspace.
- They may be able to use some of their own network of contacts to develop new opportunities and sources of funding.

Further into your project, you may start thinking about recruiting volunteers to help with the running of your activities.

Volunteers can be a real asset to your makerspace. They can help with the running sessions, with admin or provide logistics support during conferences or workshops. How a volunteer supports your makerspace may depend upon their own unique personality, skills and abilities. In return, they are able to develop new skills and experience and have the opportunity to expand their network.

Volunteering has wider benefits such as:

- Helping to develop an individual's confidence
- Providing the opportunity to give back
- Helping to guard against loneliness and isolation
- Giving an opportunity to bring the community together

A word of caution…

Whilst it is absolutely true that volunteers can make a fantastic contribution to your club, volunteers can also take up a lot of your precious time. This is because the volunteers will need to be briefed on the rules and health and safety requirements of your makerspace and will require some form of training to carry out their duties. After putting in this time commitment, some volunteers do not remain committed for very long.

We have found that the relationship between organisation and volunteer works best when you have clear set of expectations regarding volunteer duties and what they can expect from you in return – even if this is just a reference.

Resources and equipment

The making you can do in your space, and therefore skills you can develop, will be determined by the equipment and resources you have available. You can start small with the basics in one particular area, and grow as your demand grows. That was the approach taken by both our teams.

Whenever possible, we always try to work with free software. This gives young people the opportunity to access that software at home and to continue to work on it for free. The accessibility and democratisation of technology is really important to us.

You'll be surprised by how much you can do for free. There are some very generous people and organisations working within the STEAM sector that have uploaded e-learning tools to the internet that can be downloaded and used free of charge under creative commons. A creative commons license means that an author wants to give people the right to share, use and build upon the work that they have created. We provide links to such resources in Chapter Four of the toolkit.

Starting a digital makerspace only takes a few items. Anything else that you choose to deliver depends upon your own interests and skills and the needs of your community.

At Wavemaker we started with 10 Windows laptops and access to the internet. In the case of EST it was a set of 5 PCs from an old ECDL lab. This allowed us to download and use free software. That was it. We increased what we offered as needed, and now have a good range of equipment, although, we could always do with more.

Below is a guide for what equipment and resources you need, and what areas they cover. They are not all essential but desirable to maximise offering.

Resources and equipment

Item	Digital Making and Design (Coding, App design, 3D design music, video etc.) Electronics	Digital Fabrication and Prototyping (3D Printing, laser cutting)
Accessible space	x	x
Storage Containers	x	x
Computers (laptops)	x	x
Raspberry Pis	x	x
Arduino	x	x
Monitors, keyboards and mice	x	x
iPads / tablets	x	x
Printer	x	x
Electronics kits	x	x
Projector & Screen	x	x
Strong Fast WiFi	x	x
Laser Cutter		x
3D Printer		x
3D Scanner		x
Vinyl Cutter/Plotter		x
Heat Press		x
Sewing machines		x
Basic tools / toolkit		x

Resources and equipment

Some of the items require more explanation as not common in a standard computer lab but very characteristic of a digital makerspace.

Raspberry Pi

The Raspberry Pi is a credit-card-sized computer that costs only around $35, plugs into a monitor or TV, and uses a standard keyboard and mouse. It is a capable little computer which can be used in electronics projects and is a good start to exploring computer programming using languages like Scratch and Python. It can also do many of the things that your desktop PC does, like spreadsheets, word processing, browsing the internet, and playing games. It is an excellent tool for beginners in digital making.

The Raspberry Pi is part of the maker movement and will let you connect with young makers from all over the world to invent a wide array of digital projects.
Adapted from www.raspberrypi.org

Arduino

Arduino boards are able to read inputs, e.g. light on a sensor or a finger on a button, and turn it into an output - activating an engine or ringing a bell. You can tell your board what to do by sending instructions to the microcontroller on the board. To do so you use the Arduino programming language and software. Arduino has been used in thousands of projects, from everyday objects to complex scientific instruments. It is supported by a worldwide community of makers gathered around its open-source platform. Their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.

All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through users' contributions. The technology is therefore particularly suited for makers interested in low cost, small scale physical computing projects.
Adapted from www.arduino.cc

Laser cutter

Laser cutters precisely cut or engrave a material using a focused high-powered laser beam. The laser beam is emitted from a laser tube and focused onto a point on the surface of a flat sheet material, melting, vaporising or burning the material at that point. This melting and vaporisation of the material, especially with plastics, leaves a melted, almost polished edge, requiring little to no finishing, depending on the finished purpose.

Laser cutters can cut through a variety of materials, ranging from very thin paper and textiles, through to Plywoods or MDF. They cannot cut through metals, stone or glass, but they can mark and engrave them. The laser also cannot be used to cut or engrave into any material containing chlorine, e.g. PVC or Vinyl. Still, the potential uses of laser cutting and engraving in a makerspace is enormous - just consider creating prototype models or various artworks.
Adapted from https://make.works/

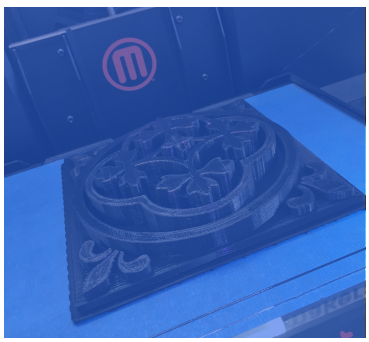
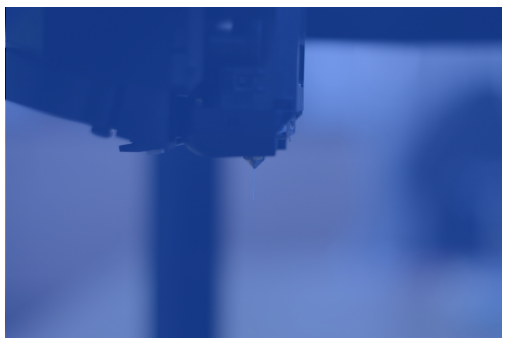
Resources and equipment

3D Printer

3D printers produce three dimensional solid objects from a digital file. The creation of such objects is achieved using an additive process, that is laying down successive layers of material until the object is created. Each of these layers can be seen as a thinly sliced horizontal cross-section of the eventual object. 3D printing enables you to produce complex shapes, layer by layer, using less material than traditional manufacturing methods. The whole process is also called rapid prototyping.

3D printers are mainly used in areas such as medicine, architecture, the entertainment industry and artisanship. However, there are more and more manufacturers that specialise in selling to non-professional users of the technology. Printers for hobbyists are much cheaper than professional equipment and the materials that the equipment needs is often less expensive. They make a great contribution to a makerspace, allowing to transform digital projects into physical reality.

Adapted from https://3dprinting.com/

3D Scanner

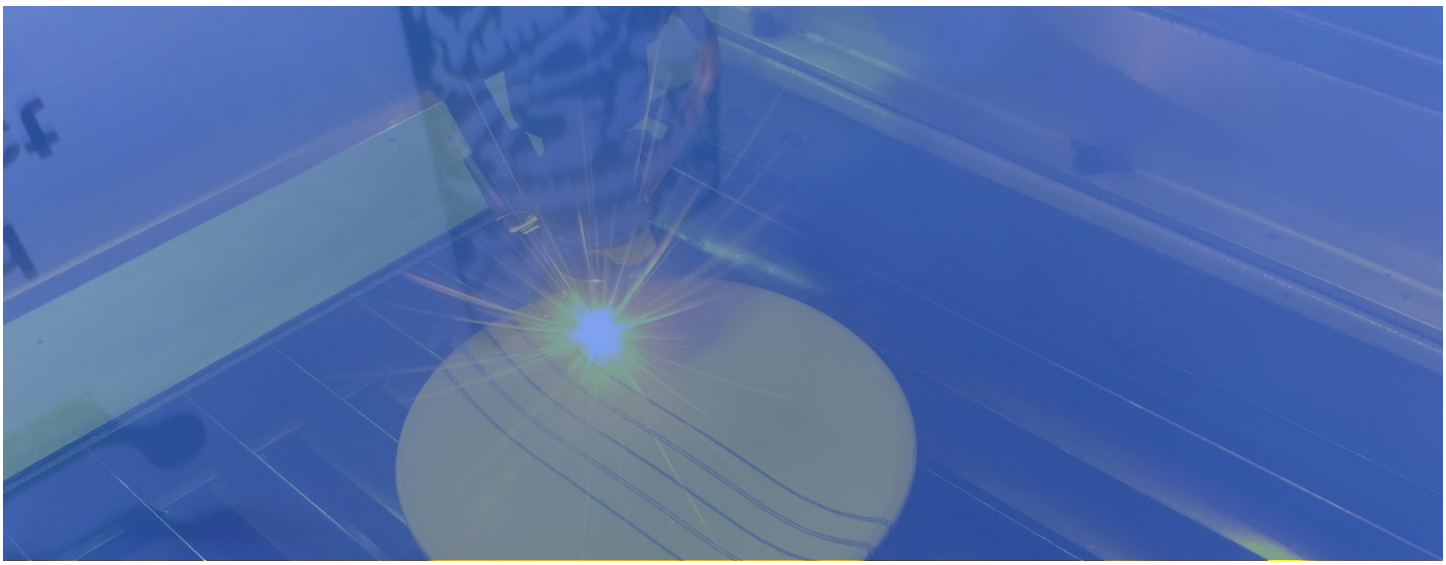
3D scanners digitally capture the shape of physical objects with a line of laser light and generate a digital three-dimensional representation. They measure fine details of free-form shapes to quickly generate highly accurate ‘point clouds’. 3D laser scanning is ideally suited to the measurement of contoured surfaces which would require massive amounts of data for their accurate description with the use of traditional measurement methods.

The 3D scanning process consists of a few phases. First, an object is placed on the bed of the digitiser. Specialised software drives the laser probe above the surface of the object. The laser probe projects a line of laser light onto the surface while sensor cameras continuously record the changing distance and shape of the laser line in three dimensions. The shape of the object appears as millions of points called a ‘point cloud’ on the computer monitor as the laser moves around capturing the entire surface shape of the object. The point cloud data files are created, registered and merged into one three-dimensional representation of the object. It can then be processed with various software suitable for a specific application.

3D scanning may substantially increase the range of 3D production projects which can be undertaken in a makerspace.

Adapted from www.laserdesign.com

Resources and equipment



Obtaining all of the equipment that you might need for your makerspace may seem like a daunting task, however, there are few tricks that you can use to keep the cost as low as possible.

- Make use of used/donated items rather than buying things new. Call upon your existing network to see what might be available. You might be surprised by how generous people can be.
- Make use of auction sites like Ebay to buy second-hand and to secure the best deal. Online shopping comparison sites can also point you towards some bargains.
- Particularly early on, it makes sense to borrow what you can - especially if the piece of equipment is only going to be used for a small amount of time. It also gives you the option to road test equipment before working out if it is worth purchasing.
- It is also possible to raise money for new equipment through fundraising. This could be an excuse for a group project. For example, young makers could create a Christmas gift that could be sold to raise funds.
- The final way to gain equipment is to bid for it through trusts and charitable institutions. When applying for funding be sure to check that you meet all of the funding requirements. These can include: geographical location, type of people that the funding will benefit, what sector the money will benefit, the size of your organisation etc. You also need to make sure that you make your application within the advertised period. Applications made outside of these time periods will not be considered.
- A final word upon applying for funding: be prepared for the fact that application forms can be laborious and many have low success rates. We suggest that you exhaust your other options before applying for funding.

Location and space

Some makerspaces have an accessible common sense space like a school classroom or a community youth centre which they can rent or borrow. If this is not the case, then some things to take into consideration when choosing a location are:

- Does the location have free parking?
- Is it close to public transport links?
- Are people within your area likely to travel to the location?
- Is it access friendly – for instance, would wheelchair users be able to use the space?
- Is it in a safe area? – This is important if young people may be making their own way to the space.

Here's some inspiration for spaces that can work well:

School/College Classrooms or Science Labs: Most classrooms have non-static furniture which can be moved about to meet your needs. For young people, they are also familiar environments that they are used to working in. Schools and Colleges are also often located in safe areas and have lit parking.

Theatres and Arts Centres: These buildings often have multi-purpose rooms that can be hired out for a small fee. They often have movable furniture as the rooms might be hired out for theatre rehearsals or business meetings. Theatres and arts centres also have some interesting resources or equipment that you might be able to make use of. Producing theatres often have workshop departments which have a range of tools and theatre props that you could also borrow. Working in a creative building sets the tone for creativity - it can help to inspire young makers.

Church Halls and Community Centres: These spaces can often be rented at a low cost and are often situated in easily accessible locations in the heart of communities. It's worth checking that there is enough furniture for your needs as resources can vary drastically from place to place.

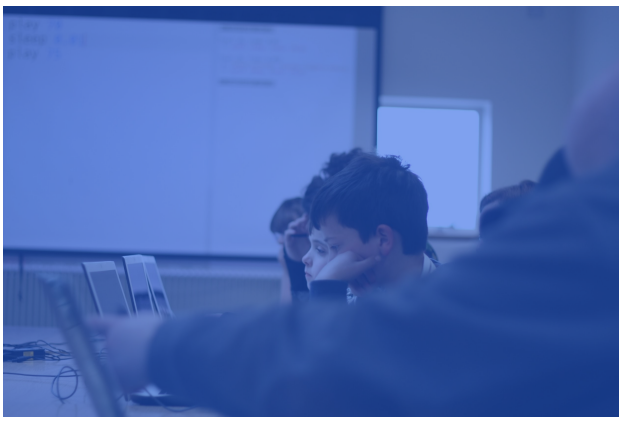
YMCAs: YMCAs often have rooms that can be rented by members of the public and organisations. They often have free onsite parking and are situated in safe areas. Working with the YMCA might have the benefit of starting collaborations as you get to know the staff and the YMCA will be in contact with a range of young people across a local area. This means that they should be able to help you to promote your activity.

Libraries: Local libraries can make a great location for a makerspace. Many libraries have rooms that you can rent or an open-plan space that you can make use of. Libraries are inviting places that young people are likely to have visited before and are used to using. There could also be some good hints and tips for projects in some of its books.

Makerspace layout and amenities

For most small scale makerspaces, the most important things that you need are tables and chairs. We also recommend using a projector or smart screen to help you to explain your task to young makers and to leave up any instructions. It's worth considering the following points when planning layout and storage arrangements:

- Does the space have any storage space that you can use in between sessions? Some of the equipment that you might choose to invest in, such as a vinyl cutter and 3D printer, can be quite bulky.
- We suggest, if possible, that the space is multi-functional so that it can be a flexible learning environment. Try not to have any fixed furniture and make use of a transportable digital projector.
- Make as many resources as you can portable so that you can take them to local schools and youth groups to expand your reach.



Health and Safety

If you are working with equipment, then it's important to have a health and safety policy in place to ensure the safety of your young makers.

The safety regulations obviously depend on the particular equipment in use, although it is important to apply some common sense when you are planning activities in your makerspace, to ensure everyone's wellbeing.

- Always emphasise safety to your participants
- Try to stimulate a culture of safety in which participants watch out for the safety of each other and respect the agreed rules
- Provide clear explanations how to use specific equipment or give adequate training on how to safely operate the tools
- Sensitise participants to possible risks and precautions that need to be taken to avoid accidents
- Always have at least one adult person present when young people work in the space
- Keep the workspace clean and tidy which helps to minimise tripping hazards (no wires running around workbenches!)
- running around workbenches!)
- Ensure that work areas are well-lit and ventilated
- Make sure that people don't fool around and distract each other while using tools
- Have first-aid kits easily accessible in the case of emergency
- Formulate all the rules in clear language and display them in a visible place
- Respect all the legal obligations relating to the safety of your space and youth activities that may apply in each particular case

If the makerspace has equipment for fabrication or prototyping of physical objects, special precautions need to be taken to minimise risk of injury. Potential hazards reflect the tools as well as the activities in the work space. We can thus only give examples of safety procedures in the case of some typical equipment used in fab labs.

Health and Safety

3D printing is becoming more and more common in makerspaces. However, it is certainly not that common to realise that 3D printers, the materials that they use and their waste products may result in health hazards. Hot parts or plastic resin can cause burns. The printing process can emit toxic volatile particles that can cause respiratory irritation. Direct exposure to ultraviolet light can cause damage to your vision. To reduce exposure to such hazards you should ensure that:

- All the users understand the printer operating instructions
- The printer is clean and in good working condition
- It is positioned away from the workstations to minimise breathing in emitted particles
- It has an active interlock system that prevents use of the machine with the moving parts exposed
- Eye exposure to laser or UV light is prevented
- The materials used are of adequate quality, with lower emissions, preferably those recommended by the printer manufacturer
- Dusts, scraps and waste are promptly removed after the printing process
- Before cleaning or repairing the printer is unplugged and cooled down

Laser cutters are also potentially hazardous machines. They use a strong beam of light to cut, drill or engrave various materials. The laser light must be contained within the cutter to prevent damage to vision. Another hazard is the risk of fire caused by the hot laser beam which can be minimised by proper cleaning and maintaining the machine. The waste material produced during the cutting process needs to be removed by a filtration system meeting the specifications of the manufacturer. Accordingly, the following precautions should be taken:

- Makers should be instructed on the proper use of the equipment, what materials can be cut and emergency procedures
- An exhaust system should be installed prior to the cutter's use and its filters regularly changed
- The process of cutting or engraving should be always monitored to prevent ignition of combustible materials
- Fire extinguishers should be available nearby to quickly react in the case of emergency

The spaces that you hire or borrow will have their own health and safety policies and risk assessments in place. Make sure that you also have an adequate H&S policy on hand if you plan to open your own space.

Sustainability and funding

One of the best ways to help make your makerspace sustainable is to build your reputation by forging links with your local community, local businesses and other organisations within the STEAM sector. By doing this, you will gain a network of support and will be the first to hear about new local funding opportunities. They might be able to offer their advice and expertise at a crucial moment in your development.

Another way to ensure the sustainability of your project, it is to capture and evidence the great work that you do. This can be crucial when applying for funding opportunities and for convincing organisations and individuals to work with you.

We have found that these things are the most important:

- **Notebooks/project binders** can give evidence of how young makers' ideas change and develop over time.
- **Blogs** are a great way for volunteers, staff and makers to talk about their work and ideas to a wider audience. It can also help to keep stakeholders up to date with any developments in your project.
- **Photos** can be taken throughout a project as a way of documenting the making processes and how much makers have learnt in a small space of time.
- **Posters** can be created for workshops and conferences as a way of showcasing the ideas of makers. These again are a good way to convey the work that your maker space is doing to a wider audience.
- **Slideshow Software** such as Microsoft PowerPoint and Prezi can present video clips, images and text which describes the journey of your makerspace to a wider audience.
- **Videos** can be used on social media as way to keep your followers up to date with what you are doing on a day to day basis. Or, more formally, videos can be created to help showcase your work to funders.

Furthermore, it makes sense to gather data and statistics on your makerspace attendance:

- Overall numbers of participants including the number of engagements and the number of retentions.
- Demographics including age, gender and where the participants are from, if possible.
- Reason for visits: general enquiries, attending a workshop, using some of the equipment.

Questionnaires can be tedious to fill in, but they are one of the best ways to track impact upon users and, if they come repeatedly, to track their journey over time. This can be done with a short pre and post-workshop questionnaire which is bespoke to what you are doing.

Sustainability and funding

Funders and local authorities are increasingly interested in the impact that your programme is having upon an individuals' wellbeing. This can be evidenced through asking participants to fill in a wellbeing questionnaire such as the Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS).

Possible sources of funding for a makerspace are many and diverse. However, they very much depend on the context in which you work and you will have to look yourself through a maze of funding schemes – local, national and European. We can only give examples of such opportunities here on the basis of direct experiences in financing our workshops.

First we should mention Erasmus+ which has co-financed activities in the MakeApp Club. The programme offers a wide range of opportunities for initiatives in the youth field. Though its budget line for equipment is very limited, and such expenses are considered 'exceptional', it's still possible to receive support with some projects (e.g. in strategic partnerships focused on innovation). On the other hand, funding opportunities for activities involving young people are immense. You should consider the following funding strands:

- Mobility for young people and youth workers. This is an excellent opportunity for visiting other maker organisations in other European countries and learning on the spot. The learning mobility can take the form of a youth exchange, training/networking for youth workers or volunteering in a partner organisation abroad. This strand of the programme is managed by National Agencies (http://ec.europa.eu/programmes/erasmus-plus/contact/national-agencies_en) which publish detailed information on eligibility of projects and receive/select applications.
- Strategic partnerships. These are collaborative projects undertaken by organisations active in the youth field or informal groups of young people which aim to develop or improve innovative youth practices. If you see your digital making project as innovative in your community and are able to extend it further to involve at least one more youth organisation from the eligible countries (EU + some partner countries), you should certainly give it a try. Similarly to the above strand, applications are submitted by the project coordinator to their National Agency.
- Capacity building in the youth field. This action is more demanding than the other two and requires the applicant to have sufficient potential to manage large-scale events or development of educational resources. However, participation of smaller partner organisations in the consortia is also welcome, especially those which link informal learning, volunteering and labour market. Maker movement has a lot to contribute in this field. This is a centralised strand managed by the European Commission's Executive Agency in Brussels.

Sustainability and funding

Funding

There are many sources of funding out there that you can access for your project/programme. These range from small pots of funding, for engagement activities and programmes in your community, through to larger amounts for large-scale engagement programmes with robust evidence and results. Each will come with clear objectives and requirements that you will need to meet and then adhere to in order to get the money or the next phase of funding. Do your research into what funding is available to you and at what level. Due to the fierce competition in the funding world, the majority of funders now want to see partnership working (who else is involved in your bid), shared resources and skills and therefore greater impact and reach.

Have a clear mission and vision statement. Know what it is you want to do and why you are doing it. You can then research into the numerous funding bodies out there and see what they are currently funding. This can be difficult so please keep in mind that some people have a full time job in sourcing funding and bid writing.

At Wavemaker we have a main spreadsheet of all appropriate funders and trusts that we continually update and review. When we look at this, we always asks ourselves the same questions:

- Are the funders open for submissions
- what is the the time frame
- the maximum and minimum amount
- what evidence do they need

This has taken time to create and populate but, once it becomes part of your operations, it just becomes another thing you regularly revisit and keep on top of. Don't be afraid to speak with other organisations that are similar to yourselves in what they offer to see where they secured funding from or what tips they can give you. They might be able to share with you where they have had difficulty and why and where they have had success. It's worth noting that some bigger funders will not give more than one payment to a group in a geographical area in the same year.

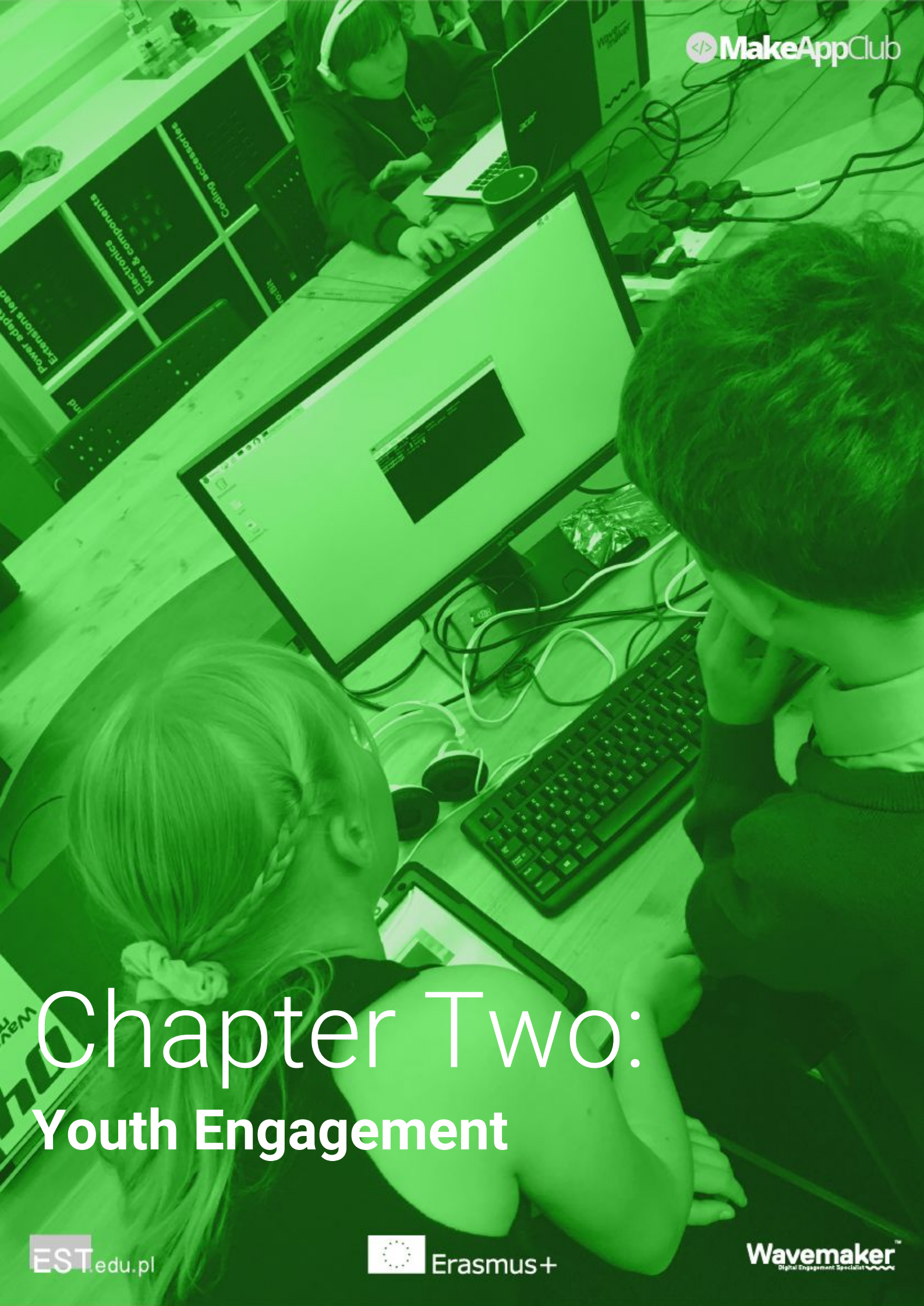
The important thing to maintain is a clear mission and vision and stick to it. If you are clear with 'why you do what you do' then you can avoid 'mission drift'. This is often the case when an organisation will bend what they do/offer in order to try and win some funding. The end result is confusion in mission and the core reason for being is diluted. This will also be obvious to your service users.

Local, regional and national funding will fluctuate depending who is in power/control and what their main aims and objectives are. Areas might include skills and training, jobs for growth, unemployment, health and wellbeing, and many many more.

Sustainability and funding

Types of funding:

- **R&D** - small to large amounts of funding to cover costs for advances in your programme. To identify a need or to advance your practice/offer.
- **Capital** - Money for building work. Renovation or new build. In some cases this will pay for goods such as equipment and licences. Normally these funding streams won't cover staff wages and day-to-day running costs.
- **Revenue funding** - This is typically a funding stream that will cover core costs and allow for an organisation to continue and deliver its aims and projects
- **Project specific** - This is what it states. Money to cover a particular project or programme of activity. These tend to be smaller and have a set time frame. i.e. 3 months. Although smaller and with a higher success rate, the majority of organisations go for this type of funding and therefore the competition is larger.
- **Sponsorship** - This could be small amounts to cover equipment or larger contributions for capital or programme delivery.


MakeAppClub
Chapter Two:
Youth Engagement
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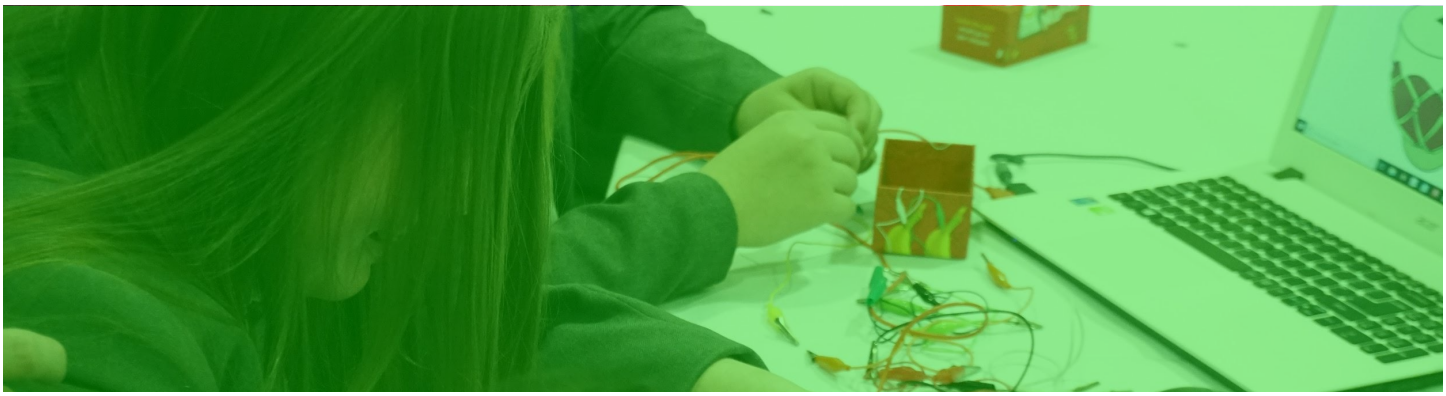
Erasmus+
Wavemaker

Chapter two - youth engagement

Makerspaces offer an opportunity for learners to take control of their own learning. In contrast to increasingly 'teach to curriculum' approaches that schools are encouraged to take, the freedom that is offered to learners means that they are able to express a specific interest and pursue a passion. The experience is all about user-led design. This is a step change in the experience that is offered and is important in a number of ways:



1. It is paramount that learners understand that any form of educational journey is a two-way transaction. Learning that is imposed upon people is seldom as effective as that where users are engaged.

2. It is also important that learners understand that they have a responsibility in learning. When learners feel that they are not only able to but are expected to take an active role in their learning, it results in a higher quality of experience. Self-determination theory (Deci & Ryan, 1985, 1991) can be applied to education in order to significantly improve student outcomes. In particular by encouraging students to value education and knowledge, and to build confidence in their own capacities and attributes. These outcomes are manifestations of being intrinsically motivated and internalizing values and regulatory processes. Research suggests that these processes result in high-quality learning and conceptual understanding, as well as enhanced personal growth and adjustment.

3. The makerspace experience is far more independent and autonomous than a traditional educational setting. Rather than receive instruction on theory, practise and delivery in an abstract setting, learners can actually get involved and are very much in control of their degree of engagement. Whilst it is important for the makerspace to ensure that all learners are engaged, the pressure differs from a traditional learning environment. If a learner chooses not to participate, the structure of the sessions allows them to withdraw for an amount of time, or for the entire class, without negatively impacting the learning of others. This autonomy highlights to the learner that they are very much in control of their experience and therefore responsible for the outcome something that is as applicable to the labour market as in education.

Attracting young people to take part in activities

Here are some things that you might want to consider when looking to recruit young people to take part in your classes or activities.

What student groups are you looking to work with?

It is useful to think about whether you would ideally like to work with students from a particular academic year. This will normally determine the type and difficulty of the activities that you choose.

You may also want to think about whether you want to target females - as there is a current disparity between levels of men and women working in the tech industry.

Or, you may wish to target students that come from a disadvantaged background. For this reason, you might chose to work with the YMCA or other similar youth-focussed educational charities.

As an educational provider in a post-industrial city, there are a variety of opportunities for Wavemaker to impact in the spaces of gender, social stratification (class) and ethnicities. These opportunities and challenges are not unique to Wavemaker, to Stoke-on-Trent or even to the UK. In many Western cultures there are cities that are moving from industrial economies to service-based economies. Opportunities exist for those who have found themselves unable to integrate into industrial labour markets to either find enjoyable hobbies at makerspaces, or to learn new skills. Makerspaces can impact the opportunities for a huge group of learners, from those not in education, employment or training (NEETS) through to hobbyists, graduates and professionals.

Attracting young people to take part in activities

Where do you plan to recruit young people from?

If you are already working within a school, college, or community youth space, then you already may have an existing pool of students/young people to recruit from. You can advertise to students through posters, notices on their online platform, and announcements during assemblies and class time. Social media channels can be a great help here as this can allow parents or guardians to see the offering that you have and how it will add to the learning experience. Your makerspace could make a great alternative/addition to an after school club, or could supplement the learning that takes place in one of these clubs.

If you plan to operate outside of a school environment, then you might look to build your reputation by carrying out workshops for schools, colleges and youth groups. You could also work with local universities as part of their outreach services. Many organisations now look to co-deliver and partner up with others in order to broaden their reach and impact. This also helps with shared resources.

Think about the best days and times to meet, and how often.

If you are operating within the context or school, then your activity may have to fit around other after school clubs and activities. If you have any say in the matter, try to avoid after school on a Friday, as young people are keen to go home. Also try not to clash with popular clubs such as football and drama.

In other cases, go with what works best for the majority of participants. Failing that, weekday early evenings and during the day throughout the summer holidays usually work well. People tend to already have commitments during the weekend or parents/carers may not be on hand to provide transportation.

Approaches to learning and delivery

Flexible approach - adaptable sessions

It is important to acknowledge sessions and workshops may not always run as planned. It is important to have an outline of how you want the session to run and you must be able to tweak, change and adapt your teachings to meet the needs of the learners. If the participants start showing genuine interest in one specific area of what you are delivering then it can be beneficial to go along with that and stray from the original session plan.

Knowing your audience / language used (terminology)

In line with being flexible and adaptable with your teachings, it's wise to acknowledge the ages, level and abilities of the group attending the workshop or club. This can often come down to the language and terminology used when conversing with them.

If you have a particular target audience then it may be easier to standardise your teachings and learning resources. If you plan to cater to a wider audience then you must be prepared for different rates of learning and therefore have differing learning pathways.

Session time and structure (learning vs playtime - breaks / think attention span)

From our findings, session times of 2 hours is optimal, with a 5 minute break halfway through. Obviously, session time would differ depending on type of session delivered.

Documentation / resources

It is important to ensure that as well as any leader notes you may have, you support learners with URLs, access to videos or hard copies of any essential user guides, especially if the subject matter is something that is completely new to the learners. This will not only help with context, but will enable learners who are particularly motivated to do some guided research of their own, whilst staying on track with the overall aims of the session.

Events and activities (contact time)

Events are the primary way in which to engage with your audience. We offer a multitude of events at Wavemaker, broken into the following headings:

Hosted events

After school clubs

After schools clubs offer an ideal opportunity to engage with younger learners, especially when setting up a space within a school or educational environment. An obvious appeal is the timing, as it often fills a void between the close of school and the evening.

Holiday period events and workshops

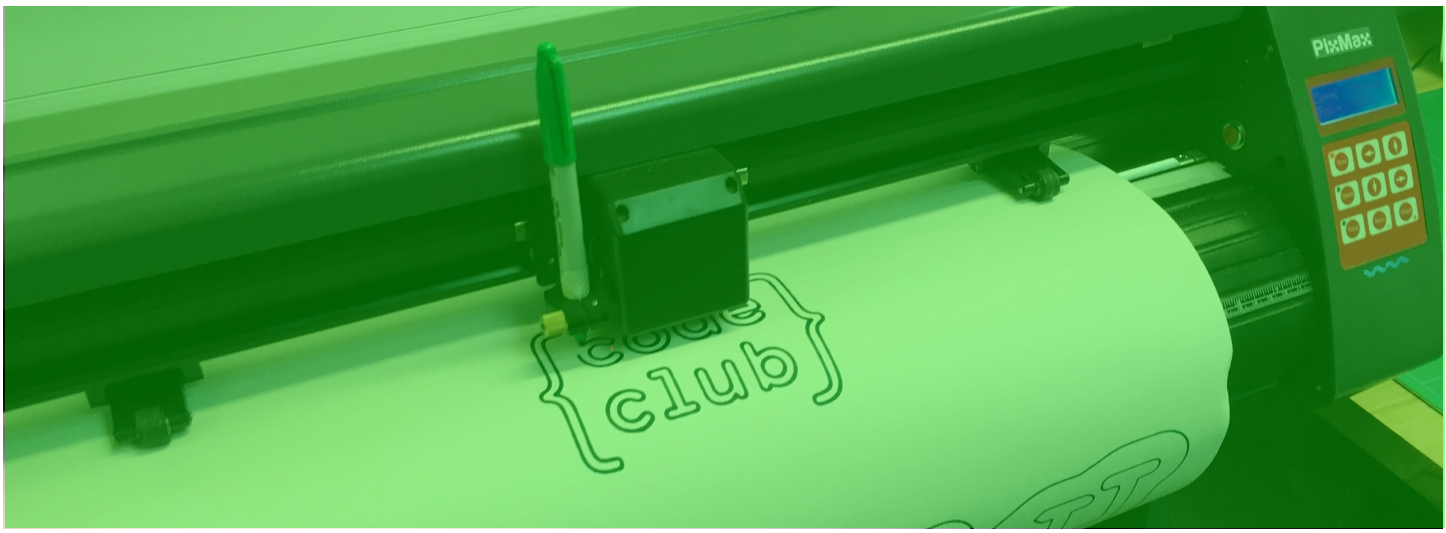
School holiday periods are again an ideal time to engage with children and young adults as you will find that they often have an abundance of time. Activities, events and workshops offer an opportunity to explore new things, learn new skills, and meet new people at a time of year where there is a need. Additionally, the time restrictions of the regular curriculum are gone - so why not schedule day-long activities, to take advantage of the time that young people might have, and which their parents might struggle to find cover for?

Organisation / group exclusive events

Many of the successful events held have been exclusive for certain organisations or groups. These work well for a number of reasons. One of these is advertising. As there is already an identified group or partner, the advertising for attendees can be more focused, and sometimes isn't required at all.

Events hosted at external locations

Attending events hosted at external locations can help expand your reach, as well as appeal to people who may not normally encounter your club or organisation.



Marketing

You only get one chance to make a first impression. Adopt this as your mantra and try to ensure your marketing materials and wording come across in a way that will appeal to your audience.

Market research

Is there an appetite?

Have you researched whether there is a need in your area? There will no doubt be some individuals who are interested but you need to be able to turn this into a sustainable community. It is critical that you ensure that the core message of your group is one that is inclusive, and isn't associated with anything that is too technical for example.

Do you have competition?

Depending upon the size of the community, there may already be a particular workshop that's established. That doesn't preclude you from starting your own but you'll want to consider whether you are going to have a different focus than existing groups. It may be the case that you feel you have a better offering which is fine but we would always recommend that you try and support other groups rather than compete against them as a matter of professional courtesy.

Time of year (do it at the right time)

There is little to be gained by having a launch event in the week before Christmas, or running your first workshop on the evening that local school children are attending a sporting event. Be aware of the local education, sports and cultural calendars and make sure that there are as few barriers to attendance as possible. We have found that the winter brings a lack of competition for after school time, so it might be worthwhile looking at seasonal offerings locally.

Where is your market / who is your audience?

Who are the decision makers?

Be aware of where you're pitching your advertising, or focusing your efforts. For example, an event for young adults must appeal to them, but if it's in a language that does not appeal and convey the message to their parents / guardians (who may ultimately decide whether their child attends), then you efforts could be wasted.

Marketing - ways of advertising

The first thing you'll want to do is to name your event. By keeping it simple clean and clear, and by choosing a name or title that describes what the event is, you will keep the language and terminology accessible.

Online

Social Media

Social media is by far one of the better ways to communicate with various communities and advertise events. Creating a page for your club / makerspace is the ideal way to go about it. This serves as a central hub to not only advertise, but to communicate also.

Event listing websites

Various event listing websites exist and are free to use. Eventbrite is one of the leading sites and we've found ourselves using this a lot. We have attracted new audiences from using this method, and have also been able to keep track and in communication with past attendees using the built-in tools on the site.

Forums

Forums offer a way to communicate within a specific category or niche subject. Sometimes this may be the only way to engage with your target audience, but can be more involved than simply posting an event on a website.

Posters

Sometimes you can't beat a good old classic printed poster. Ensure you cover the basic information such as dates, times, locations, and of course, event title and description. Pop these in windows and on notice-boards at places where your target audience is likely to visit.

Feedback and evaluation

Feedback and evaluation is invaluable when assessing your impact when making tweaks and improvements. Depending on whether you have received funding, this may be a requirement from the funding body.

Event Reflection

It's always good to evaluate and reflect on your event or workshop. This does not necessarily have to be a formal procedure, but just a few minutes to think about what went well, what didn't, and what could be improved.

There are a number of factors which will determine whether your event was a success or not. But what does success look like? This is something you will need to decide. Do you have numbers in mind; targets? Sometimes an event may not have been classed as 'successful' for reasons beyond your control. For instance, it could be that you had very few attendees at your first workshop. This does not mean failure, it just requires more time to become established and reach the right audience.

Reflecting on these will help you refine what you're doing and improve moving forward.

Learner feedback / evidence capture (did they get what they wanted?)

There are several elements to consider when understanding the outcomes. There is a need to understand that the most interesting activities from the perspectives of young people may not be the most academically or vocationally robust - and some may only contribute marginally to the acquisition of specific skills. However, all are may be exceptionally popular. In order to understand the effectiveness of all of the activities that are offered there is a need to reflect on all activities and analyse the outputs.

The challenge therefore is to ensure that there is an academic and vocational robustness to the offerings in order that the learnings that are taken are real and replicable and not simply perceived, or simply a 'fun' afternoon with nothing taken away. Likewise, young people will not respond well to a session that feels like it's an extension of a school or college class.

The measures that are being used are a contribution to social and technical skills, and the overall contribution to the employability of the learner that this is likely to have.

The activities delivered are split into three key areas:

- Attendance optional - sessions such as Code Club, animation classes and seasonal maker classes
- Attendance captured - mobile maker sessions whereby Wavemaker attend a public space and engage with an event
- White label classes - Wavemaker deliver sessions to a curriculum designed for a third party. i.e the YMCA.

Feedback and evaluation

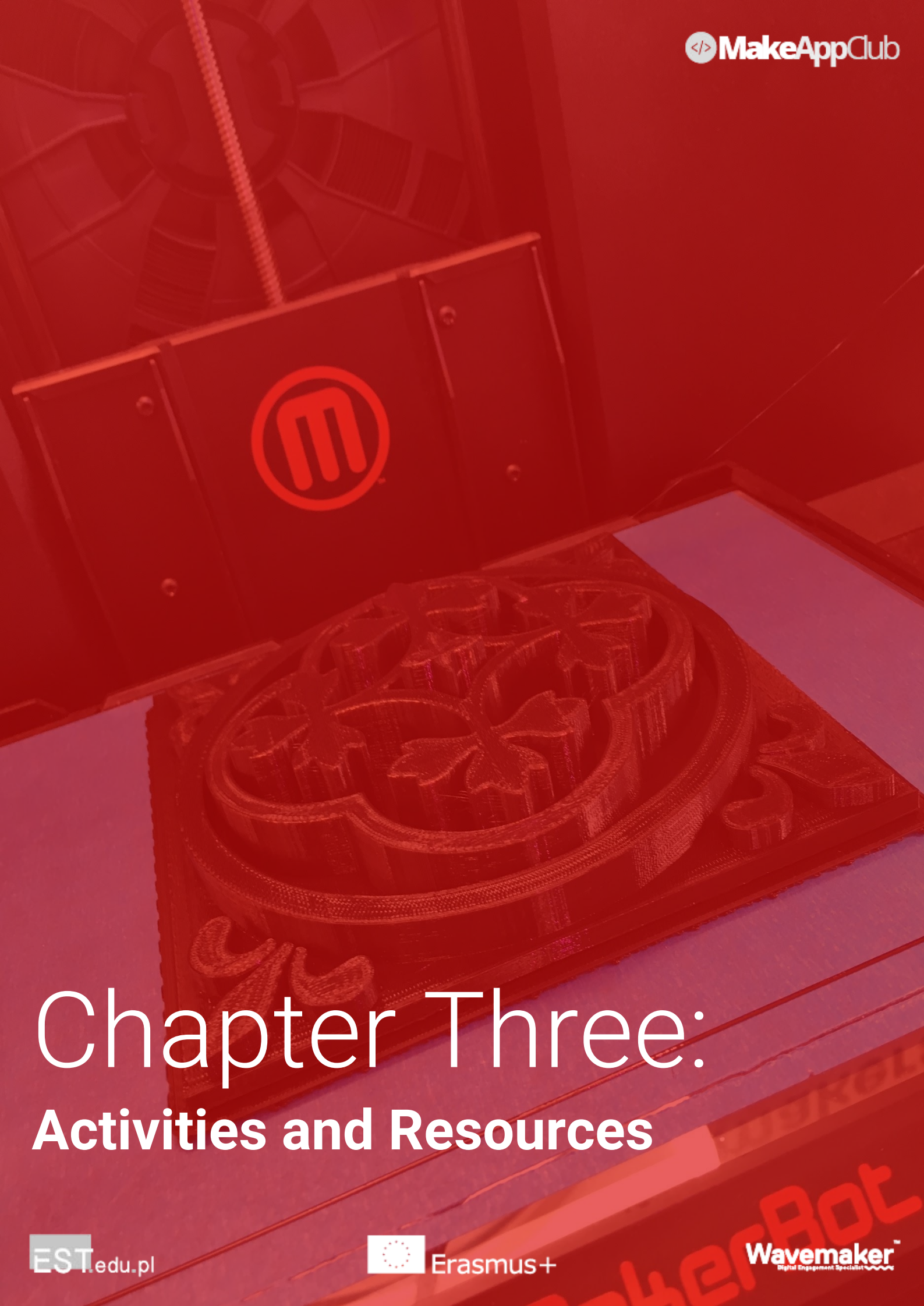
Pre and Post activity questionnaires

RAG Rating

A quick and effective method to get a base level of before and after feedback is by adopting a red, amber, green system. For each workshop you wish to evaluate, use a Google Form to create multiple choice questionnaire relating to the areas within your learning. Learners can quickly select where they feel their ability lies, giving the tutor an idea of their level. Repeat the same questionnaire and compare the answers to see if there was an improvement in the learner's skills.

Lollipop stick

Less of a record but more visual, and therefore useful for reflection, is the use of a lollipop stick. Each learner has two: a red stick and a green stick. The leader can ask about each section, with the learners holding up the relevant stick to state whether it was good or not.



MakeAppClub

Chapter Three:

Activities and Resources

ESTedu.pl

Erasmus+

Wavemaker

Chapter Three: Activities and workshop resources

In this chapter, we present some digital workshop activities that attract interest from young people and how they relate to the development of their technical, social and employability skills. There is a wide range of creative activities with proven potential and we focus here on those which can be initiated with small investment in a small makerspace. Before going to detail, let's consider some prerequisites essential for planning a successful digital make & learn event with young people.

Location

You might already have a limitation on where you can host your event if it's required to be a part of your makerspace portfolio of events. If you don't, are you able to take your session offsite? This is likely to happen at some point if you're following our tips – we have already run multiple sessions in a completely different city. So what will you need to think about? Is your location well-suited? Is it accessible to everyone – that includes people in wheelchairs? Does the building have wifi or are you going to have to arrange an alternative? Is there technical support on-site? Who is going to fix anything that goes wrong? If it's not at your regular location, do you have enough mains extension leads? What is the worst thing that could happen to prevent the session from going ahead and what is your plan if that happens? It's surprising how much more in control you'll be if you already know the answers to these questions.

Advertising

If you are tasked with advertising the event, how will you get word out to people? Are you charging for the event? Make all costs very clear in your advertising. If it's free then make sure to show that in big bold text on your flyers but also be prepared for people to book and not turn up if there's no cost. Keep your branding consistent so if things go well, people remember who you are. Ask attendees where they heard about the event so you know the best place to advertise next time. Be prepared to run several events before word spreads enough to fully book your events. If instant roomfill is a requirement and the budget is excessive, remember every scene has its heroes. For example, lots of youngsters follow Minecraft celebrities on Youtube and getting someone like Stampy Cat or Dan TDM to your event would ensure it is well advertised and an instant sell-out - if you can afford their fees.

Chapter Three: Activities and workshop resources

Resources

What are you going to need for the event? Are you supplying computers / laptops / iPads / xBoxs etc. If so, how are you going to protect them from accidental damage and theft? Are you supplying all the licensed copies of software which people will use? Will you use the regular home versions or the Educational versions? Will you be connecting to a server on the internet or will you have one powerful PC for the other machines to link to? It's possible to get your own server hosted by companies that specialise in providing online servers for educational purposes and these can be an efficient way to provide a custom server with 24/7 access but you still need to check the network at your location can cope with your planned number of simultaneous users.

Costs

There's no getting away from the fact that setting up a successful digital maker group is going to cost something - unless you can get the location, equipment, software, server, advertising and technical support for free, along with a couple of volunteers to run the session. One addition also worth considering is some form of snacks for the attendees. It doesn't matter if you split your session and make this a formal break or provide a table away from the group that people can check out when they want to. We tend to favour individually-wrapped light snacks and fruit but variety and freshness is key. Anything left at the end of our sessions goes to our volunteers and visitors. We try to provide something different for each session to advocate diversity and inclusion. Be prepared to meet some very young vegans and make sure there's something for them. Obviously avoid giving peanuts to strangers! Make sure you ask parents about dietary requirements or be very diverse with the foodstuffs you provide.

The Brief

When you know who you're interacting with, what are you going to try to get them to learn or understand? Digital making activities are a great tool for teaching a wide range of skills, both social and technical. Sessions usually work best if there's a theme which people can contribute towards. For example, in our Minecraft sessions, we have asked groups to join together to build our city of the future, robots, canals, communal spaces and towers. For digital game making we publish a brief in advance. The announcement covers a concise definition of the theme, an explanation of the challenge or concrete tasks and the timeframe, with lots of in most cases, the whole making process cannot be completed in one session.

Chapter Three: Activities and workshop resources

Be Social (Media) Ready

Some participants (and/or their parents in the case of minors) aren't too concerned about appearing on social media. Others can have good reasons to object. Always check for permission before posting. We've discovered over time that a good solution is to check when people book on to the event and if they object, get them to wear a lanyard or no-photos sticker on the day. You can explain this is so the photographers will know (and if you have a helper who can dedicate some time purely to event photography, it will save you from even having to think about this any further). As it's a social setting, it's a good idea to get everyone (kids, volunteers and event staff) to wear name badges anyway. When you get around to reviewing the pictures, it will be instantly obvious whether you can include them within your social media output or not.

Planning for chaos

It may sound bizarre but it can be helpful if you plan for the worst that could happen. If you are prepared for many things going wrong then you only have to apply your contingency plan for the unexpected event on the day. There are some things which would inevitably disrupt your session (like fires and natural disasters). Catastrophic events like these are serious enough that you don't have to worry about being expected to continue with the session; just make sure everyone you are responsible for is ok and you have contact details for parents and carers if you're forced to evacuate. For every less serious and more common eventualities, it’s a good idea to be prepared. If you don't currently have a plan, find a sheet of paper and a pencil and quickly jot down what you think is going to happen and how everything is going to run. The following checklist can help you review your preparations.

The Quick & Handy Event-Planners Checklist

Location	• Is it your usual venue? If not, where is the event? • Is it accessible? • Do people know how to find it? • Do you know how to get there? • What time will you need to leave home on the day of the event?
Advertising	• Who is responsible for advertising the event? • How much does it cost? • Who is it aimed at? • What's included? • When is it? • Everyone can help get the message out – ask colleagues, friends & family to retweet posts and/or share links.
Resources	• Do you have enough computers for everyone? • Does everyone have licensed software? • How many people can join the server simultaneously? • What happens when someone turns up without their game system because they only have it on Xbox and decided not to bring anything when they read it was a PC-based session?
Session Plan	• Can you explain the brief in 10 minutes or less? • Can it be completed in the given timeframe? • Include time for getting people logged-in and connected to the server. • What happens if you run out of time to get motivating results? • Is there a follow-up to such a session?

The Quick & Handy Event-Planners Checklist

Planning for Chaos	• Do you have back-up plans at the ready? • Are you ready for any/all of the things we've faced so far? • It's ok for a first event to not go to plan but after the third you will appear unprofessional.
Session review	• How many people attended? • Is there a reason for a low turnout? (first events or holiday time) • Do you need to expand or create a waiting list? • How did you cope with the actual event? • Was your brief too long or too short? • Did you get good feedback? • What did attendees really like? • What did attendees really dislike about the event? • What can you do better next time? (make notes now before you forget) • How did attendees find out about the event? • Where else could you try advertising next time? • Will you do another event or not? (either way, post pictures on social media if possible)

Engaging digital making activities

In what follows, we'd like to present some activities that we offer to young digital makers which have attracted their authentic interest and had an impact on the development of their technical, social and employability skills. A brief overview in the following table is then explained in some detail through concrete examples that illustrate the generic categories outlined here. This is obviously a selection from a wide range of learn and make workshops that a digital makerspace can offer to young people. Still, we believe that this typology covers the whole spectrum and the following examples can inspire similar initiatives in other youth work contexts.

Activity type	Technical	Social	Employability
2D design	Adobe Illustrator, materials composition, operation of laser cutter or plotter	Problem solving, troubleshooting, fact-finding, teamwork, resilience	Communication skills, fact-finding, confidence, presentation
3D design	Adobe Illustrator, materials composition, operation of laser cutter or plotter, 3D layout software, 3D print concepts, plastics properties and uses	Problem solving, troubleshooting, fact-finding, teamwork, resilience, time-planning	Communication skills, fact-finding, confidence, presentation, design concept drafting
Fabrication and Manufacture	Adobe Illustrator, materials composition, operation of laser cutter or plotter 3D modelling and prototyping, Arduino	Problem solving, troubleshooting, fact-finding, teamwork, resilience	Communication skills, fact-finding, confidence, presentation, design concept drafting
Programming and coding	Raspberry Pi, BBC Microbit, Scratch	Understanding complex problems, troubleshooting, fact-finding, teamwork, resilience	Communication skills, fact-finding, confidence, presentation, design concept drafting
Web and design technologies	Adobe web tools (free), Photoshop, Illustrator, WordPress	Understanding a project brief, fact-finding, team work	Communication skills, managing conflict, presentation
Creative gaming	Minecraft, server, understanding 3D spaces, materials properties, creating assets for 3D game environments	Teamwork, collaboration	Managing conflict, communication

Each of the above activity types includes remove exciting potential for creative workshops that can have different forms and content, depending on the interests of young participants, their age and skill level as well as the availability of properly equipped space and qualified mentors. Our selection, proposed here, represents this variety of interests, competences and digital tech.

2D Digital design

No matter where you go, you will find examples of design. It's a necessary part of our lives and, because of this, there is a massive demand for people with design skills and knowledge, to help plan future projects- from simple packaging to architecture. At Wavemaker, we recognise the need for these kinds of skills. That's why we've taken the time to offer workshops specialising in both 2D and 3D design.

Here are some tips from Wavemaker on how to run your own workshop on both 2D and 3D design.

Hardware and Software: We use Adobe Illustrator CS2, which runs on both Windows and MAC. This particular version is free and one of the main reasons we use it. The software needs to be installed on the device before it can be used. If you/the user wants a more up to date version of the software, you will need to pay a monthly subscription to keep using it or a prepaid yearly plan. If you don't already have an Adobe ID, you will be prompted to create an account with them.

Timing: It's recommended that you load up Illustrator on all of the machines that you will be using in the workshop to save time. Expect a lot of questions and uncertainty from the group in the beginning, especially if they have never used illustrator before. Because of this, it's usually a good idea to go step by step with them to make sure that everyone is aware of what they need to do. The different tools can seem quite scary at first but once the students get used to their functions, they usually manage quite well by themselves. The session will usually run for, at least, an hour.

Backups: Make sure to have the group save throughout the session to protect their project in case their computer should shut down or there is some other technical issue.

Network Issues: If the programme fails, try and reload it- hopefully restoring the file, as it has been saved (see above!). If the computer has died, plug it in for charge as it may have gone to sleep and Illustrator will reload and the person can carry on. If the wifi goes, try reconnecting the device.

The Admin Guide: Don't forget to have a key instruction manual or document with helpful tips on hand nearby to help answer any questions and help prompt you throughout the session.

Regaining Control: By inviting people to get creative and make up their own designs, there is a chance that people will become overly excited. If you feel like you need to get back control of the session, try telling people that they only have so long left to finish their designs.

Programming and coding: Code Clubs

Coding is something that is growing in demand and popularity but many people still don't know what it is. That's why, at Wavemaker, we set up our 'Code Club', giving kids from the age of 9-13, the chance to learn about coding and what you can do with it, all whilst in a safe and encouraging environment that promotes playing and making as much as learning.

Here are some tips and ideas to help run a successful Code Club of your own.

Hardware and software: Swift Playground (Apple) is a great app to help introduce kids (and adults) to the basic concepts of coding, whilst keeping things interesting and easy to follow. There are numerous levels or options of play and the app is completely free however, it is only available through the Apple app store, so you will need either MACs or iPads for the session. Another worthy example is Code Hub for android.

Timing: This depends on what kind of coding session you choose to run. If you are using Swift Playground, the group can start immediately and the app will explain the process. We advise though, that you make sure to dedicate at least five minutes at the beginning to give a tutorial or, alternatively, give the workshop in stages, allowing the group to complete one task at a time.

Backups: With Swift Playgrounds, the app saves the progress as you go through the levels. With other apps just remind the group to save at regular intervals to make sure they don't lose any progress in case their computer crashes or they have some other technical difficulties.

Network Issues: Check the wifi to make sure that the device is connected. If it still doesn't work, try coming off the app and entering it again. As a last resort, you can try turning off the device and turning it back on again or re-downloading the app.

The Admin Guide: Manuals for Swift Playground are available on the Google Play store and on Apple's App Store. It is always a good idea to have an offline copy of basic commands and instructions- just to be on the safe side. There are also lots of great instructional videos that are available.

Regaining control: Thankfully, the apps are pretty immersive. If you do find that you are losing control of the group though, encourage them to try and complete some of the challenges- for example, in Swift Playground, you are encouraged to combine elements to find the robot's body parts.

Fabrication and manufacture: Robotics

Robotics is an excellent way of connecting design, making and programming and as such can be used as an inspiring activity for both groups of children and youth adults. There are many kinds of robots designed for educational purposes on the market, however, we would like to focus on those, which you can build from the beginning on the 3D printer, and then programming.

Here is one of them – Otto - and tips how to play with him in your makerspace.

Hardware and Software: To call Otto to life, you'll need a 3D printer (even a small one – the parts are not too big) and laptop/PC to code it. You need also to buy some electronic parts from the Arduino family. The full specification is available on the OTTO DIY community (https://www.ottodiy.com/) and on the www.thingiverse.com, where there are many versions of this open-source robot. GitHub is a place where you should go to find all the tips for coding. There are several ways to code and play with Otto. You can use scratch, a mobile app (Android only, and only for robots with Bluetooth sensor), or more advanced coding. It all depends on the willingness and advancement of the group members. For the most advanced members of your group, there's also an open gate to customise the robot and sharing experiences with the wider community.

Timing: Printing the basic Otto takes about 10 hours and sooner or later everyone gets bored waiting for the end. For this reason, it is good to always have some parts printed in advance and print only examples during the workshops with groups. We used to print the parts that were already designed and available on Thingiverse website, and learnt how to prepare them for the printer. You can use the time spent printing to introduce the following steps of building the robot: connecting electronic parts, coding, etc. When the group is prepared, assembling and basic coding of Otto takes usually about 1-2 hours. The rest is playing and experimenting.

The Admin Guide: Building and coding Otto is a quite complex process, with at least two different stages requiring different group dynamics – printing and coding. In a group of 5-6 members, everyone should go through the full process of preparation of the printout, but keep in mind that there may not be enough time for all of the individual models to be printed. It is good to devote some time at the beginning to explain the goals and steps to the group. It's also worth being prepared with some spare parts of robot and electronics, as a backup in case something doesn't work.

Regaining control: Usually, people work at different speeds. You may lose control over the group when the faster ones start to become bored when waiting for the rest. Let people work on other tasks or try to encourage them to solve more difficult issues. Be careful starting the first printout. Everybody wants to look inside the printer. When the robots are ready and the young coders already know how to use them, the robots can start to fight, which is completely normal. If you want to avoid accidents, try to find some special tasks or competitions.

Web and design technologies: WordPress authoring

WordPress Content Management System is a great solution for anyone who wants to start working on their own website. One can start building their own blog, or any other type of the website, without any programming language knowledge and start to learn it- something encouraged by the challenges appearing from the process of building with WordPress.

Here are some tips from EST to plan a successful WordPress session.

Hardware and Software: WordPress is an open-source software, developed by the community of people from all over the world, and it is available online (https://wordpress.org). As we want to have fun with designing and admiring our websites online, we should have a proper server and domain to install the system and PC/laptop/MAC and any similar device to manage the platform. On your device you should have a browser (or several browsers for testing) and FTP client (FileZilla, Windows Commander or any other) installed. Unless you really want to, there's no need to buy domains for all the participants. For practising purposes, it is enough to create catalogues under one domain and assign them appropriate databases.

Timing: Though the site boasts the Famous 5 Minutes WordPress Installation, and this amount of time can be achievable for more advanced users, it is not necessarily realistic for beginners. However, it is possible to go through the full installation process during one 2-hour session. It is necessary to do some introduction (PPT or video tutorial) for the people dealing with this system for the first time. A good idea would be to organise a series of workshops in several weeks, starting from the installation and going through updates, changes, users feedback, etc.

Network Issues: Stable and fast internet connection remove is a must. It is particularly important when you are uploading the new system or working on the server. Any interruption may cause problems by destroying your work and you will have to start from the beginning. It is also important with all the work, which you are doing online to save constantly. Of course, by having backups (especially the external ones, see below) you can always restore the web and start from the certain point, but why should we spend too much time on unnecessary work?

Plugins: While the "pure" WordPress doesn't give you too many possibilities of enriching your website, there are thousands of different plugins supporting the development of the frontend and backend. With help of plugins, you can change your website into an online shop or online community, find tools for online platform management, organise files or media, and connect your web to social networks and google analytics. They can help you with creating portfolios, movie shows and arranging documents, as well as much more.

Backups: In this case, backup is the crucial thing, especially when you are working on your site for a longer time- not just one day. Obviously, you need to save each change on the website (new post, new page, etc.), but what it is also very important is to remember to backup the whole website. It is advisable to do the backup before and after any bigger change on the website. In the case of active websites, you should set up an auto backup and save it to storage spaces other than your server from time to time. There are good plugins for that purpose.

The Admin Guide: There are many online guidelines and video tutorials for self-learning, which can be used by the leader of a group and supplemented by the individual advisory. The admin should secure the server, equipment and internet network and assist the group with all the step of preparing environment and system itself.

Regaining control: When working with WordPress, people are usually focused and there are no problems with controlling such a group. The main task for the facilitator is to react to all the issues which they have with their tasks.

Creative gaming: Minecraft as a Learning Tool

At Wavemaker, we discovered early on that Minecraft can be an excellent way to engage youngsters and get them working together towards a common goal, but it can also be a treacherous path for the unprepared. We have, over time, built up a community of regular minecrafters, many of whom also attend our other events such as animation workshops, Code Club, creative/seasonal maker sessions etc. We have experienced what works, what causes problems and how to get things back on track when something goes wrong (and it probably will at some point).

Here are some tips from Wavemaker to plan a successful Minecraft make and learn session.

Hardware and software: We use the PC edition of Minecraft. This runs on Windows, Linux and MAC. Users will require a Mojang account is required to access the PC edition. Other versions (such as Playstation,, xBox etc) require different methods of access. New users can go to Minecraft.net to set-up their account and download the Minecraft client PC edition.

Timing: Plan for at least three minutes start-up support per attendee. If possible, have each computer set-up with its own profile so the visitor just has to click play. Keep the session brief to 5 minutes if possible (10 minutes maximum) and make sure you know how to teleport players back to the starting point.

Controlled Areas: In survival mode, it's possible to keep players in or out of certain areas by building bedrock structures. Remember, though, that when they respawn they will be somewhere else.

Plugins: Grief-Prevention and Worldguard can be very effective at limiting the damage players can do to others (or their builds). Some players may struggle with these plugins but they are worth using if you have one or two catalysts in the group. Just watch out for X-min when you forget to change a default value in a config file.

Op commands: 'Op' is the Minecraft server equivalent of Admin or Root. The Op has access to control commands like /tp (teleport) which can be an effective way to control a disruptive player. Even in creative mode, an Op can quickly /tp such a player back to them repeatedly until they realise it's pointless trying to disobey the Op. Familiarise yourself with basic Op commands

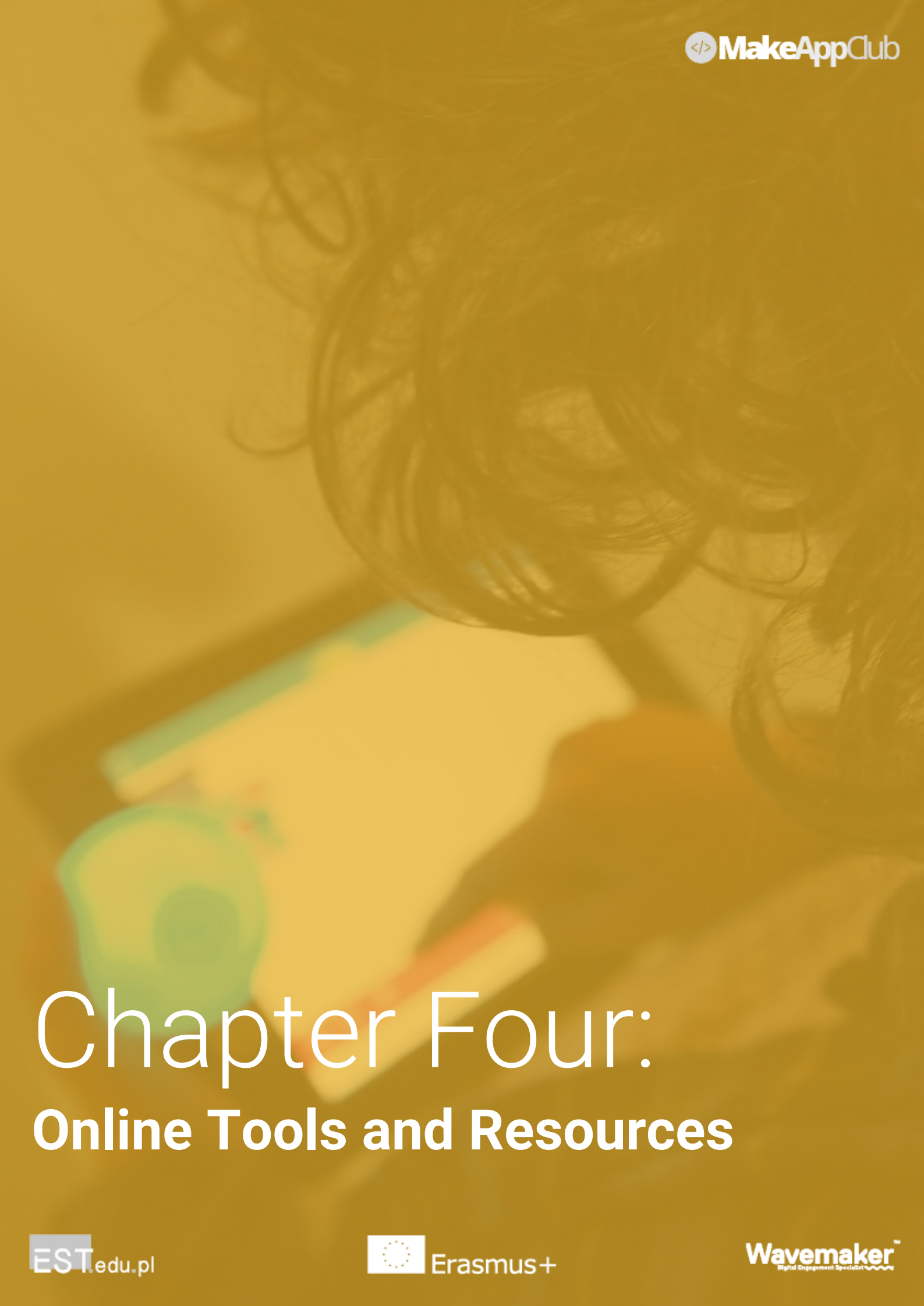
Backups: Keep a backup of your world file if it's important. Also keep in mind that if you have to revert to a backup, X-min will accuse your server of being a museum piece.

Network issues: Just have everyone play the single player version until its fixed.

Device failure: Hopefully you brought at least one spare laptop / mouse etc.

The Admin Guide: Don't forget to document the important stuff. Have an admin guide available (offline too) in which you can keep track of information you might need in a hurry in order to get a session back on track if something goes wrong.

Regaining control: Have an 8-bit Steve-head mask on standby. If the kids won't listen to you, there's still a good chance they will listen to Steve.



MakeAppClub

Chapter Four:

Online Tools and Resources

EST.edu.pl

Erasmus+

Wavemaker

Chapter Four - Online tools and resources

We are interested in creating a resource of free coding/authoring tools that are especially useful at the initial stage of setting up a digital club. Whilst working on this toolkit we were inspired by various sources to which we've linked below, for which we also recommend for use by other people of similar interests.

Information and Guidance

How To Create a Makerspace: A Real-World Case-Study
Kindle Edition by Ron D. McFarland Ph.D.

Makerspace Playbook
https://makered.org/
Toolkit for setting up and creating a makerspace -School Edition

Projects, tutorials and guides

Thingiverse:
http://www.thingiverse.com
A site where people can show off their 3D designs and be inspired by new ideas. The site also has suggestions for how to use creations in lessons, based on classroom ages and subjects.

Instructables:
http://www.Instructables.com
A site that teaches you how to make creations through online classes and demos, lets you share them with others, and runs contest with prizes.

MakerFaire:
http://makerfaire.com/
An organisation that encourages 'Maker Faires' around the world- fayres that are family-friendly and focus on creativity, innovation and resourcefulness.

Infographics making

Piktochart:
http://www.piktochart.com
A website that allows you to create charts and visual guides showing data. Once you create an account, you have access to a wide variety of templates.

Venngage:
http://www.venngage.com
A website that offers various plans, including a free one, where you can create charts and visual aids to display and explain data.

Canva:
http://www.canva.com
The site (and app) is free to use but designs do come with a canva watermark over them unless you pay to download them. Templates include facebook banners, posters, infographics etc.

Vizualize:
http://vizualize.me/
They specialise in resumes but they also offer graph, map and other infographic templates.

Easel.ly:
http://www.easel.ly/
Easel.ly is ideal for educators, students, business owners, and executives who need to convey a thought, lesson plan, or concept in an easy-to-follow visual form.

Online tools and resources

Coding tutorials & projects

Raspberry Pi:
https://www.raspberrypi.org/
A UK based charity that wants to teach people digital making to solve problems and to equip them for the jobs of the future. They offer free resources to teach people about computing and making, and train educators who teach people the skills.

Code.org:
https://code.org/
Code.org® is a non-profit dedicated to expanding access to computer science in schools. Their vision is that every student in every school should have the opportunity to learn computer science, just like biology, chemistry or algebra, and they offer projects for kids to try.

Hour of code:
https://hourofcode.com/uk
A global organisation that encourages people to take part in an 'hour of code' to get people learning about coding. They offer suggestions for activities, tools and resources to promote 'hour of code' events.

Code Academy:
https://www.codecademy.com/
An education company that teaches the basics of coding for free via their website. They also offer courses to teach people how to build websites etc.

Family Code Night:
http://www.familycodenight.org/
Family Code Night is a whole-school family event that dramatically ignites coding and computer science learning at any elementary school, and in any family. The program uniquely engages children, and their parents or guardians, in the delightful experience of doing their first hour of computer programming together, in an early evening special school program.

Microbit.org:
http://www.microbit.org/
The Micro:bit Educational Foundation is a non-profit organisation enabling children around the world to get creative with technology and gain digital skills in school, in clubs and at home.

Coursera:
https://learntocodewith.me/coursera
An online course provider, offering a wide variety of courses. Lessons are taught through recorded video lectures, auto-graded and peer review assessments, and community discussion forums.

Khan Academy:
https://www.khanacademy.org/
An online course provider that offers subjects such as maths, science and engineering, computing, arts and humanities, and economics and finance.

MIT App Inventor:
http://appinventor.mit.edu/explore/
An organisation that allows everyone, even children, to build fully functional apps for smartphones and tablets. The group offers a wide array of resources such as tutorials and advice to help run sessions.

Online tools and resources

Educational Gifs

507-Movements

http://507movements.com/

A series of images showing how to set up different mechanical movements and mechanisms.

Collaborative web tools

Trello:

http://www.trello.com

A site (and app) where you can have 'boards' (different pages) that hold tasks that need to be completed. You can assign tasks to members of the team and add attachments, comments etc.

Slack:

http://www.slack.com

A platform that connects teams with the apps, services, and resources needed to get work done. Categories can be used to separate teams and help with collaborative working.

Airtable:

https://airtable.com/

Airtable was founded on the belief that software shouldn't dictate how you work—you should dictate how it works. Their mission is to democratize software creation by enabling anyone to build the tools that meet their needs.

Asana:

http://asana.com

A collaborative site where team members can share tasks and have all current projects available and visible in one place.

Avaza:

https://www.avaza.com/

Software that helps with project management, scheduling, timesheets, expenses management, invoicing etc, all in one collaborative space.

Click up:

https://clickup.com/

Calling itself the 'Productivity Platform', the software allows you to assign comments to tasks, integrate your Google calendar to events and deadlines, and assign tasks to other members of the team.

Kanban tool:

https://kanbantool.com/

The software allows you to categorise tasks into boards, analyse projects and manage them better, as well as organise, share, and attach online documents for the rest of the team to access.

Yalla:

https://www.yallahq.com/

An interface that allows you to easily manage your team and their workload through their intuitive drag-and-drop interface. The software also offers project management and task assignment.

Online tools and resources

Event Listing

Facebook events pages

https://www.facebook.com

Just click on 'Events' and 'Create Event' to start adding details and advertise your workshop or talk.

Eventbrite

https://www.eventbrite.com

A website to advertise events. Go to the page and click 'Create Event' on the top right to get started.

Craigslist

http://www.craigslist.co.uk

Go to the site and click on 'post to classifieds' on the top left. You can advertise a lot of different things on this site from activities to things for sale.

Reports

NESTA - Young Digital Makers Report March 2015

UNICEF: Children in a Digital World

Magazines

Make:

https://makezine.com/

A magazine that talks all things making- from different projects you can try to articles on technology.

Hackspace:

https://hsmag.cc

A magazine that talks about technology and different projects that people can try.

3D Design resources

Tinkercad:

https://www.tinkercad.com/

Tinkercad is a simple, online 3D design and 3D printing app for everyone. Tinkercad is used by designers, hobbyists, teachers, and kids, to make toys, prototypes, home decor etc

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