

# Methodology scale up



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The MOM methodology consists of three primary elements:

1. The use of a dedicated set of cards that allow students to create their own challenge question either individually or working in groups;
2. The makeathon context in which students can collaborate, test ideas and do hands-on building with a combination of technological tools and craft materials;
3. A teacher guide that allows an educator or facilitator to manage the educational process through a series of games, activities and clear steps.

## 1. Cards

The MOM cards methodology was developed as a way to (semi-)randomly generate research questions and allow the students to create their own challenges so that solving them would not only be a practical and hands-on way of learning in a new arena, but also a way of incentivising that learning by connecting them with problems that are directly meaningful to them.

The **Mind Over Matter** team have observed that this way of connecting challenge creation that reflect the students' own interests and values with both creative practice and scientific techniques provides a new synthesis of previously separate knowledge domains. By bringing these things together, students not only understand the connection and relevance of the different subjects but also gain a deeper understanding of the individual subjects themselves.

This connection of subject areas and support of subject knowledge is a strong recommendation for educational institutions aimed at 13-18 year-old young people to adopt (and potentially adapt) the MOM methodology.

## Careers

Participants are introduced to a wide range of STEM and STEAM careers through the cards. Many of these occupations are either not known by the students or not well-understood, and the opportunity to explore those gives the participants the chance to expand their conception of what they might want to do beyond formal education - or how they might want their future formal education to develop. The integration of existing careers into the MOM cards methodology lends itself to use within careers programmes and further education preparation and recruitment within educational institutions.

## Art

MOM participants included both creative and science-oriented students. The integration of a variety of arts and creative practices within the cards allowed the groups to explore ways of expressing their ideas beyond the usual written work or class presentation usual in formal education settings. This element of student work and potential assessment is something that could be adopted more

broadly - not just within creative programmes but also more technical settings.

## SDGs

Students are already taught about the SDGs in Sweden, but this is treated as part of Social Studies and not something that can be practically engaged with from a creative or scientific perspective. As discussed above, this compartmentalisation of knowledge separates the important development goals as something that students 'know' intellectually from the things that students 'do' practically. Thus, they are not typically understood as issues with which students can directly engage and actively contribute towards. Using the SDGs within the cards methodology allowed students to synthesise the knowledge of the development goals with their own individual and group experience, thereby bringing together different aspects of their learning.

## Concept

The Concept cards were introduced to add something of a 'random' element to the challenge-setting activity for which the cards are used. However, the words included within that category were all deliberately selected to be active verbs that the students could incorporate in their research question creation. By doing so, the students were led to think of academic enquiry as a platform for direct engagement. Words like 'reduce', 'improve', 'communicate', 'teach' and 'collaborate' empower students to centre themselves as agents of change, rather than external observers to phenomena that are outside of their control.

## 2. Makeathon

The Makeathons held for the MOM Erasmus+ project developed as a result of the pilots, in which the making process was trialled and reflected upon, and through the series of National Makeathons held in each of the partner countries. The International Makeathon followed an evolution of the earlier facilitation guides and included activities and interventions that enhanced the Makeathon experience and results.

After the introduction of the cards and having the students work with them, they were invited to go through a process of word association with the cards, coming up with new, related topics. In this way, the cards became a springboard into a compelling challenge rather than a restrictive set of words that the students must adhere to as a task to complete. In combination with a discussion round in which participants talked about issues that were particularly important to them, the word association and ability to introduce flexibility into the idea generation process allowed participants to construct a research question that they were invested in solving.

Groups were formed by assigning numbers to each student (sequentially, eg: 1-6 where 6 groups would work best), rather than by allowing students to congregate in their usual friend circles or gravitate to those they believe are most like themselves. This allowed for students to test their ideas

and preconceptions against others who were not necessarily of a similar background or mindset.

Each group was also assigned as a 'mentor group' to another group, tasked with helping make the other group's project as good as it can possibly be - providing additional outside perspective and reality checks on a group's challenge and potential solution. This contributed to a much greater sense of collaborative work towards positive societal goals, rather than a competitive environment in which one group's work would be judged better or worse than another's.

Students were supplied with materials, including a selection of recycled and 'found' objects gathered from the Återvinningcentral (recycling station) in Umeå. These included metal buckets, pipes, decorative items, ceramic bowls, a lampshade, and so on. The objects were not obviously useful for integration into creative technology projects that address grand societal challenges, but the students were able to use them in either a practical or symbolic manner as additional props and materials that took their ideas in new directions, while underpinning the ecological and sustainability issues at stake in their projects.

The technologies used were programmable micro boards (particularly the BBC Microbit) and a wide range of sensors that the microboards could use as input. Students were invited to explore and experiment hands on with the different types of sensors (humidity, light, proximity, temperature, sound, etc.), which afforded them new ways of thinking about possible solutions to the challenges they had created. Key to the MOM Methodology was the idea that providing students with an exposure to a broad range of technological possibility in order to achieve a creative or societal goal opened up both the options within the challenge itself, and the potential to see a pathway or career that might involve these sorts of technological tools. A key guiding principle of the MOM project and the Makeathons was to broaden students' understanding of what is possible and achievable using STEM and STEAM methodologies.

Microbits are already fairly widely used in schools across Europe, but not specifically for use by creative/arts students and the possibilities of the tools (including sensors) to develop creative projects that address grand societal challenges was something that was seen as positive and desirable.

As an extension of this, and despite the seriousness of the challenges and the technical nature of the toolkit, efforts were made to give the participants a sense of fun and creativity to allow their minds to generate playful and more creative solutions to the problems presented. Facilitators provided teams with balloons and bubble mixture without much explanation, and students explored these - not only to engage in childlike play but also to incorporate these elements into the practical solutions and prototypes they created. Breaking down a separation between what is playful and what is serious removed student preconceptions about what an 'acceptable' prototype answer might be to a serious grand societal challenge.

Prizes were awarded, though these were done in a sense of fun and parody rather than competition. Recycled and 'found' objects were given award status - for instance, 'the plastic tree award for

environmental impact' and 'the metal pipe award for applied research'. All groups were awarded prizes that celebrated what was best about their own work, without singling any group's out as better than any other.

The results of the Makeathon and the student presentations were filmed and made available online to demonstrate good practice outcomes for others that might wish to adopt the methodology in future. We have had interest from international schools asking to get a copy of the cards, and positive feedback from visiting teachers - both from neighbouring classes and neighbouring countries - who would like to introduce the methodology in their own curriculum.

### 3. Teacher Guide

The online Guide that has been provided to teachers, youth workers and facilitators for the MOM project is conceived of as a 'living document', which grows and changes in response to the on-the-ground application of the methodology. As new approaches, suggested new cards and useful adaptations of the methodology emerge, the document can be updated and amended. The guide is also provided as a printable PDF document

that educators can share with colleagues.

### Shareability of the methodology

The MOM cards and teacher guide are available for free online to anyone who wishes to use it in their teaching or curriculum. In addition, the MOM website ([steamproject.eu](http://steamproject.eu)) has a digital version of the cards that can be played without a physical set being needed. This allows groups to trial and assess the methodology for themselves, leading to greater potential uptake.

### Local reflection

#### Sweden

In Sweden, there was a lot of interest in the methodology, but a great deal of caution about introducing new elements into an education process that had already been greatly disrupted by Covid. As a result, MTF Labs were only able to run the shorter version of the pilots, but were able to introduce more of the hands-on making than was originally envisaged for this duration of pilot.

The success of the short pilots (3 hours) was noted by visiting teachers, who would ordinarily not seek to introduce additional project work to their own classes, but noted how much could be achieved in challenge creation and prototyping within a single afternoon session. MTF has been approached by teachers both in Swedish and Finnish schools asking about the possibility of having access to the cards and guide beyond the life of the MOM project.

The International Makeathon was held at A Working Lab in Umeå university, a co-working, meeting and incubation space for startups and local businesses. Organisers and members reacted positively to the activity and site manager Philip Hopkins said that this was something that AWL should be

doing a lot more of: integrating local high school aged students in entrepreneurial and creative innovation lab activities in a context that allows them to see the possibility for their ideas to be ushered into reality with support from a university-based innovation ecosystem. He felt that this was a good way to show students a pathway to both further education in STEM subjects and STEAM careers.

While the cards are provided as an open source resource for any educators to print and use, MTF is currently examining the potential to print and sell pre-made decks, as this has been specifically requested by educational partners.

## Croatia

In Croatia, young people and youth workers as well as teachers in primary and secondary schools reacted positively on the methodology. First reaction of young people was complete confusion - working with non-structured task was something new. The surprise and confusion was greater for young people who do not participate usually in non-formal educations while it was lower for those who do. They were surprised with the fact that they have to research and come up with the solution by themselves and that we, as their mentors, are convinced they will learn a lot and come up with a concrete solution to a world problem.

In general, youth workers and teachers to whom methodology was disseminated finds methodology very interesting, but are still sceptical that will work well with young people they are working it or that they will know how to implement it. On the other hand, youth workers and teachers who tried out the methodology with us during the project implementation are very positively surprised with the efficiency of the methodology on many levels. What they find most surprising, beside how great solutions young people developed, is the devotion of young people to the task and absence of “free riders” within the teams. Other aspects they like are possibility to use the methodology on variety of topics, being STEM oriented or not, within different time constraints and without specific tools or equipment.

Youth workers and teachers are interested to have methodology adopted to children and youth above 18. For the children, 10 to 13 years, STEM, STEAM and SDGs have to be explained more in the beginning, and some of the concept cards adjusted, while for young people over 18 they think that this “lead” brainstorming as they refer to the first phase of the methodology, is much better than approach we are usually using - introducing one concept and let young people brainstorm around it.

Local opportunities to scale the methodology include its integration in different types of youth trainings, from STEM, STEAM, IT, to entrepreneurship and sustainable development. As far as formal

educational system in Croatia is concerned several types of integration is possible: (1) within civil education curriculum, (2) as a part of cross curricular themes, (3) as a methodology used during class meetings, (4) for the project days in the schools.

Eventhough we implemented piloting with around 80 cards in set, we have developed more than 200 cards from which we extracted 80 cards used. More cards are available in decks “carrier” and “concepts”. Therefore, we have enough material for the adjustment of carriers and concepts to make sure young people don’t get used to the cards.

Eventhough cards are available online, both young people and youth workers prefer working with printed cards. Therefore, 100 piles were distributed among NGOs and schools and CTC Rijeka is considering further printing and selling.

## Lithuania

At Siauliai tech we put big efforts to disseminate the information of ongoing project and involve young people to familiarise with concept of the game and it’s process. We have organised a few multipliers events for teachers, educators, decision makers and business as well pilot where young people actively took part.

We organised several pilot trainings of a different length with secondary and higher secondary school students. We noticed that the best scenario is a full-working day (with lunch break included) or several workshops in 3 days with adapted process. In this case participants can still stay in the working flow and pay attention on the task and complete it.

The national makeathon was a great success involving 12 teams with 48 participants in total. Participants had a chance not only to work in teams, create the solutions and prototypes, but also develop social skills like critical thinking, creativity, presentation skills.

The „Mind over matter“ has got a lot of interest from teacher as well. Teachers who took part in Multiplier events or other activities pointed out that they would like to have a deck of cards and use them during the lessons. Teachers mentioned that the methodology is a great way to teach young people in interdisciplinary manner and combine the subjects to solve the global problems. In Siauliai Tech we already use the methodology in other projects based on STEAM education. One of the next step is submit the training course for Lithuanian teachers and teach them how to apply the cards in their educational processes.

## Spain

In Spain, the schools that took part in the piloting sessions were very happy with the result and liked the methodology a lot. Nevertheless, we find it really difficult to attract people to participate in the activities (makeathon, multiplier events, focus groups. Moreover, due to the Covid – 19 situation lived in the previous years, students didn’t want to do anything else online that’s why we struggled



so much to reach the objective set on the project proposal. The majority of educational centres wanted to run the medium versions (cards game + prototyping).

During multiplier events, we were asked to create the cards in Basque as well, as there are lots of schools where their teaching language is Basque. We could send the translation to the Croatian partner so they can create the virtual cards in Basque too.

During the national makeathon we had the opportunity to prove that, when youths had a “big objective” like winning the prize of traveling to another country, they tried much harder and the ideas they came up with were much more innovative.

The international makeathon was a great experience for the winners, and they even asked us if we were doing it again next year. They liked the fact of working in multicultural groups and getting to know more about the peculiarities and habits of different countries, plus, it was a good way of training their language skills/competences.

## Italy

In Italy, the methodology developed within the project using design thinking through cards was very much appreciated and we had the opportunity to apply it not only in project activities but also on different occasions.

During the first project phase, it was very complicated to organise long-term piloting in present, the covid disrupted classroom teaching.

Consequently, the CLF4D activities opted for many short pilotings with the middle schools and longer online pilotings with the high schools.

Only the middle schools used the kits, the same tools are not included in the high school didactics, so it is difficult to have the older students physically build prototypes. Instead, they preferred to create digital prototypes: applications, virtual reality structures, websites for sustainability.

The piloting was much appreciated by the teachers, they noticed that the students develop more creative ideas from that kind of brainstorming.

The final challenge in Italy was a success, the students co-created digital prototypes, and pushed to the Swedish goal of the international makeathon.

During the makeathon in Umea, they were able to develop and implement the idea and, above all, they had the opportunity to confront themselves with different realities and students from different European countries, also improving their English level.

The CLF4D proposes the methodology in its activities using it for brainstorming and team building given the success in classroom activities.



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