

# Chaos and order in maker coaching

Towards a pathway for library makerspaces

Manon Mostert - van der Sar

m.h.van.der.sar@hr.nl

Hogeschool Rotterdam

Rotterdam, The Netherlands

Peter Troxler

p.troxler@hr.nl

Hogeschool Rotterdam

Rotterdam, The Netherlands

## ABSTRACT

Ten years have passed since makerspaces first appeared in libraries, and their contribution to developing digital literacy and 21st-century skills is widely recognized. However, mounting and running a makerspace still means embarking into new territory for each next library, as this Dutch study with novice maker coaches showed.

Novice coaches struggled whether to structure making activities more stringently or more loosely. A stringent approach impeded creative and playful tinkering, while a loose approach risked resulting in too much chaos. Experienced facilitators were familiar with including more loose, playful elements in their activities. Still, they felt they needed to master the new domain of making which hindered them from effectively employing that experience. Through collective reflection and individual coaching, the maker coaches learnt to constructively deal with the tension between creative chaos and productive structure. This paper proposes a pathway to successful maker coaching which will be tested further.

## CCS CONCEPTS

• **Applied computing** → **Collaborative learning**; **Digital libraries and archives**; • **General and reference** → *Empirical studies*.

## KEYWORDS

makerspace, library, librarians, maker coach, chaos, structure, coaching, learning

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## 1 INTRODUCTION

More than ten years ago, Fayetteville Free Library (FFL) in New York State started the first makerspace in a public library [10]. Since then, more libraries started to embrace the concept of makerspaces. Makerspaces became one catalyst in the transformation of libraries from repositories of knowledge to the libraries as informal zones

for active participation and knowledge creation [15]. They connect to the natural need of people to create, and more generally they aim to become the place to nurture lifelong curiosity as the basis of lifelong development. Makerspaces are about making as a way of learning that appeals to a range of competencies and that connects people. By providing a makerspace, libraries can play a vital role in the societal transition to lifelong development by becoming broad social-educational facilities that meet changing needs in local society.

In the past years, a lot has been written about makerspaces in general or specifically in libraries [11, 16–18]. These publications provide generalized roadmaps or manuals on how to start a makerspace. Still, libraries (and schools) experience difficulties implementing these spaces into their local practices. Previous research mainly focuses on the professional development of maker teachers in formal education (see e.g. [5, 6, 14]). Librarians, however, come from a different professional background. So, for them not only making is new territory, but often running creative workshops, too.

In this paper we report from an ongoing study on training librarians to become maker coaches. We specifically were interested in how librarians shift their way of working from a linear to a more iterative process in which they are able to quickly learn from their activities and program different activities based on their own timely or local challenges.

## 2 METHOD

With the desire to help libraries embrace the opportunities of makerspaces we choose participatory action research [7] as our principal research approach. Epistemologically, we subscribe to Law’s “after method” proposal [8], that social science “can participate in and guide that change” (p. 6), but that “we need to discover ways of making methods without accompanying imperialisms” (p. 15). That means that we centered our approach around gatherings and conversations. We employed models such as the realistic evaluation cycle [13] – asking what works, for whom, under what circumstances – and elements of visual ethnography [2, 12] to gather rich and nuanced data that allowed us to access the practice and voices of the maker coaches.

In the project makerlab [1], a consortium consisting of the Dutch Royal Library, Rotterdam University of Applied Sciences, Technical University of Delft’s Future Libraries Lab, and FERS a service provider to libraries in the Dutch province of Fryslân, and several local libraries, embarked on research into the design of makerspaces at eight public libraries, generally using a research by design approach. Specifically, the project was looking into spatial design and the programming of maker activities. In the first year of this two-year project, we coached four libraries that were starting a



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makerspace and initiating activities there. Each library participated in the project with at least one maker coach, but most coaches intensively involved other colleagues in the lab. Two of the four maker coaches were trained as librarian or library assistant, one was trained in new media and digital culture and one as program manager with a background in leisure management. The four libraries organized eighteen activities in total, including activities like creating vinyl cutting stickers, lasercutting wood and acrylic, sublimation on mugs, Lego Spike programming, Duplo storytelling, gaming in VR and 3D printing of houses to scale. The libraries a wide range of equipment, such as lasercutters, vinylcutters, 3D printers and pens, VR glasses, sublimation machines, Lego Spike, heatpresses, CNC cutters, drones, green screens, cameras, Duplo, home automation kits, laptops and all kinds of tinkering material. The focus of our research was the challenges maker coaches experienced and how to help them cope with these challenges, rather than the maker activities themselves.

So, the evaluation of the activities – which we carried out together with the maker coaches – followed three lines:

- (1) Individual coaching (1:1 sessions) – After each (maker)activity we evaluated the activity in (online) one-on-one sessions. In these sessions, which took roughly 1 hour per session, maker coaches shared their reflection on the activity and we asked questions about (1) the activity (before, during and after), (2) about the role as facilitator (their role, their actions, and their response) and (3) about the target group (the profile, tips & tricks, and reactions). During these sessions we made notes which we transcribed afterwards and analyzed.
- (2) Photovoice [9] – The libraries took photos of their activities. Participants who joined those activities had given written permission to use these photos for research purposes. These photos were then shared in a private, collective chat group with all four libraries where the maker coaches would react to each others contributions. The photos were then stored in a safe research drive and analyzed in a collective evaluation with all four libraries. All platforms used conformed to European GDPR standards.
- (3) After the four 1:1 sessions, we hosted a plenary session in which we printed out all photos from the sessions and together with all libraries evaluated the activities. This started with organizing the photos in chronological order and presenting the activity to the other libraries and then other libraries wrote down on post-it's what they noticed on the photos. We then asked the libraries to cluster all these photos from all libraries together. They came up with clusters like having fun, making mistakes, working together, helping, using space, and sharing. We ended the session asking the maker coaches what they will *start*, what they will *stop* and what they will *continue* to do. With this, we proactively asked maker coaches to reflect on each other's goals and actions and give feedback and tips.

In general we were looking for what worked, for whom, under what circumstances. Maker coaches mainly focused on answering this question for their own library, while we took a more overall

perspective on what worked, for whom, under what circumstances for maker coaches in general.

### 3 RESULTS

The results in this section are based on the reflections of us as participatory researchers – meaning that we as researchers worked with members of a community to understand and resolve community problems, to empower community members, and to democratize research – and of the maker coaches on the process in which the coaches organized maker activities and reflected on them. All four libraries that entered the project were new to makerspaces and to making in general. The maker coaches were novices in terms of familiarity with (digital) making, with makerspaces in general, and with facilitating maker activities specifically.



**Figure 1: Reflecting on the photos in chronological order from the session (left), clusters based on photos of the activities own photos, © 2021 by the first author.**

As all four maker coaches who joined the project were either new to making in general or less digitally literate, they were librarians or project managers, we had to train them to become makers and facilitators of maker activities. Due to their lack of expertise with the machines, they felt a continuous need to master these machines. They indicated that it took a long time to get to know the machines, and that they did not have enough time to become experts or even competent users. In fact, they reported that they spent less than a day to get to know the machines. This perception of lacking expertise made them insecure, so in most cases, they developed strict scripts for the workshops they were supposed to facilitate, and they used rather traditional, linear designs – start with a welcome, follow up with a presentation and then give participants the opportunity to make something.

Maker coaches reported that it was exciting to discover that a more iterative design of a workshop helped them to structure the process of making. For example, one maker coach designed a virtual reality (VR) workshop in a traditional way. When we discussed the planned activity with them, we suggested creating more small iterations in the session instead of participants waiting for each other to complete the task and hand over the VR set to the next participant. After the session, this maker coach confirmed that the small iterations rendered the workshop more interactive and made it easier for the coach to help participants because the questions were smaller, even though they did not succeed in completing all their scripted iterations in time.

Another maker coach, discussing their lack of expertise, called it rather liberating to understand that it was not necessary to be an expert on a certain machine when giving a workshop using that machine. This felt uncommon for the coach as a trained librarian. Yet another maker coach discovered that it was both fun and valuable to let kids discover new materials by themselves and give them the task to explain their findings to other kids.

Next to (the perception of) a lack of expertise with the machinery of a makerspace, facilitators were also new to facilitate specifically making. This resulted in many questions on the scripts of their workshops beforehand, and in some cases it required extra coaching sessions. The number of questions and extra sessions decreased with each activity they facilitated. And while some librarians would not facilitate and host maker sessions in the future (but would hire other people to do so), they felt more confident with this kind of activities. This was not only visible in their way they more loosely scripted their activities, it was also mentioned in the coaching sessions. We noticed that the maker coaches reflected deeper on their own actions (“I did not take enough time for the reflection at the end. Next time I should not only take more time, but also involve coaches in helping me and participants with that.”) or did get a better understanding of the differences in target groups (like: “with group A, I noticed that the speed of processing was much lower than with group B”). They noticed that a higher level of digital literacy resulted in a faster processing speed.

So, we discovered that the coaches of all four libraries struggled with designing and facilitating maker activities, particularly because machines and techniques were new to them. We found three struggles with facilitating these activities: (1) the level of expertise of the facilitator, (2) the iterative process of making, and (3) the ambition to work with new target groups.

An overarching theme was to deal with the tension of chaos and order in maker coaching. In both general evaluations and one-on-one sessions maker coaches reflected on the tension between chaos and order in making. Novice coaches struggled with structure and the question when to script making activities more stringently or more loosely. A stringent approach impeded creative and playful tinkering, while a loose approach risked resulting in too much chaos. Experienced facilitators were more familiar with including more loose, playful elements in their activities. Still, they felt that the need to master the new domain of making hindered them employing that experience effectively. Through collective reflection and individual coaching, the maker coaches learnt to constructively deal better with the tension between creative chaos and productive structure. However, and not surprisingly, the tension between creative chaos and productive structure did not necessarily always result in an optimal balance.

In their process the maker coaches learnt as facilitators:

- How to deal with their level of expertise
- How to attract colleagues as coaches for the activities

Next to their role as facilitator they learnt about making activities:

- How to structure an activity using an iterative pattern (before)
- How to improvise during the activity (while)
- How to reflect upon maker activities (after)

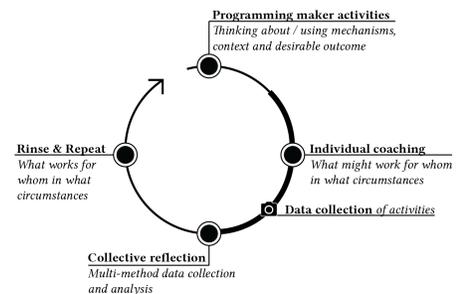
And finally, they learnt to deal with new target groups:

- How to redesign a maker activity for another target group
- How to reflect upon maker activities with the target group

#### 4 A PATHWAY TO SUCCESSFUL MAKER COACHING

So, what could be a successful pathway to maker coaching? Our attempt consisted of four elements: programming maker activities, individual coaching, collective reflection, and “rinse & repeat” – coaches learnt from mistakes through reflection (rinse) and continued and expanded on their successes (repeat).

This pathway makes use of the ‘realistic evaluation cycle’ [14]. The cycle stipulates that first, propositions should be made about how mechanisms are fired in contexts to produce outcomes. This is the step of programming maker activities where maker coaches design and plan activities that fit their timely and local challenges. The rest of the cycle builds on these propositions. The next step can be seen as a formulation of hypotheses by breaking programs down so in order to identify what measures might produce change. We did this through individual coaching, helping the maker coaches to specify their activities. During the execution of activities, observations and other data needs to be collected – for instance by making photos during the activities. Testing the hypotheses is done through collective reflection, based on the collected data. The fourth step of the cycle – before entering new programming for maker activities – seeks to specify rather than unconditionally generalize what works for whom in what circumstances. As rinse & repeat it consists of eliminating elements that did not work well enough (rinse) and continuing and expanding on the successes (repeat).



**Figure 2: The pathway to successful maker coaching own artwork, © 2021 by the first author.**

Following this pathway, the maker coaches gained new knowledge and skills that could be described in three categories as mentioned earlier: facilitating maker activities, programming maker activities and new target groups. We plan to share these findings with all libraries with (the intention to start) a makerspace as part of a practitioner handbook, too.

#### 5 DISCUSSION

Our preliminary results suggest that librarians, despite initial struggles, can become maker coaches and, can relatively quickly adapt to a new way of learning and working – all while doing so. Librarians

as aspiring maker coaches learnt how they can constructively deal with the tension between creative chaos and productive structure. This might also be an interesting approach for other user classes such as teachers and in general actors with a more structured attitude as opposed to more creative professions. A particularly interesting question would be to relate the chaos and order dichotomy to scaffolding approaches in formal, non-formal and informal maker learning [4]. Mastering chaos and order might also help understanding similar tensions like, for instance, those perceivable when introducing new technology in the classroom.

We preliminarily found that individual coaching combined with collective reflection worked, yet it is too early to conclude success. The project continues with four new libraries which will give us the opportunity to question the utility of the pathway, so it could eventually become standard practice for (Dutch) public libraries which aim start a makerspace. Planning and delivering maker activities would certainly feel different for librarians in advanced makerspaces who already have experience as maker coaches.

Employing a somewhat messy approach to method [11], we strove for congruence of research design and research topic. The research design was less a means to derive general results from a standard process. Rather, we employed a weekly standardized process – that had the purpose to coach novice maker coaches – to gain a better understanding of the practicalities of this process. This makes the products of our research – the results – less comparable with studies that methodically strive for precision. Yet we believe that the more vague or even ephemeral outcomes of our study resonate more closely with the desired reality of making, and the tension between clarity and mess is felt in the practices of library makerspaces, too.

## 6 CONCLUSION

Not entirely surprising, the project showed that working as a librarian is not the same as working as a maker coach. The biggest difference appeared to be the iterative, creative process, and specifically its lack of predictability. While librarians were used to being experts in their field, they were now beginners as maker coaches and were exposed to a different process of learning. Specific training (although small), individual (peer) coaching and collective reflection helped librarians to blend into the role of maker coach more easily.

This first iteration in the makerlab project helped us to develop, deliver and experience a pathway to successful maker coaching. It contributed to libraries with a beginner level of expertise not only to start a makerspace but also to deal with the tension between creative chaos and productive structure in the deployment of their maker activities. Novice maker coaches developed new skills which continued to add value for the libraries. So, these libraries seemed well equipped to develop new maker activities and learn from them. It will be interesting to study their further development in the light of the patterns for sustaining makerspaces in libraries identified in the Danish context [3].

The suggested pathway could eventually evolve into a ‘tool’ for other libraries who want to start or restart their makerspace as well. More research is needed on the use of the pathway with other public libraries with another level of expertise. In the second year of the project, we continue our research with libraries that are at

an advanced level of making and of makerspaces, as well as of facilitating activities. Finally, we are considering transferring our approach to our university libraries.

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