Electronic Communications of the EASST
Volume 85 Year 2025

deRSE25 - Selected Contributions of the 5th Conference for Research Software Engineering in Germany

Edited by: René Caspart, Florian Goth, Oliver Karras, Jan Linxweiler, Florian Thiery, Joachim Wuttke

Organizing software community workshops: Experiences from three independent simulation software projects

Jean-Noël Grad, Gerasimos Chourdakis, Bernd Flemisch, Christian Holm, Leon Keim, Benjamin Uekermann, Rudolf Weeber

DOI: 10.14279/eceasst.v85.2700

Electronic Communications of the EASST (https://eceasst.org).
Published by **Berlin Universities Publishing**
(https://www.berlin-universities-publishing.de/)

Organizing software community workshops: Experiences from three independent simulation software projects

Jean-Noël Grad [1,*], **Gerasimos Chourdakis** [2,*], **Bernd Flemisch** [3], **Christian Holm** [1], **Leon Keim** [3], **Benjamin Uekermann** [2] **and Rudolf Weeber** [1]

[1] jean-noel.grad@icp.uni-stuttgart.de, christian.holm@icp.uni-stuttgart.de, rudolf.weeber@icp.uni-stuttgart.de
Institute for Computational Physics
University of Stuttgart, Germany

[2] gerasimos.chourdakis@ipvs.uni-stuttgart.de, benjamin.uekermann@ipvs.uni-stuttgart.de
Institute for Parallel and Distributed Systems
University of Stuttgart, Germany

[3] bernd.flemisch@iws.uni-stuttgart.de, leon.keim@iws.uni-stuttgart.de
Institute for Modelling Hydraulic and Environmental Systems
University of Stuttgart, Germany

[*] These authors contributed equally

Abstract: You have developed an open source scientific software package and it has now become popular. Congratulations! Your software has entered a new phase of its life cycle, and you have an opportunity to steer your academic career in a new direction. Your new responsibilities include: training the next generation of users, identifying and converting power users into contributors, making your software visible to a wider audience, and creating spaces for your community to meet and collaborate on joint projects.

Organizing a short workshop, summer school or user meeting is an efficient and highly rewarding way to work towards these goals. By gathering your community in a physical location, you can help them engage in collaborative work, learn about emerging research topics, discover new applications for the software, and develop new features to meet user needs. But how much effort is it? How do you fund this event? How do you advertise it? How do you provide incentives for people to attend? How do you strike the right balance between training, research talks, and collaborative sessions?

We answer these questions through the lens of the ESPResSo summer school, the preCICE workshop, and the DuMu^x course, three events organized annually in Stuttgart, each one attracting 20–50 people every year. They combine talks, training, poster sessions and user support sessions for newcomers and seasoned users alike. Common strategies are summarized in a list of good practices with an intended audience of early-career researchers and junior Research Software Engineers (RSEs).

Keywords: community, event, workshop, summer school, training

1 Introduction

As a software maintainer, user–developer meetings are an important instrument to grow your user base, identify and convert power users into contributors, foster knowledge exchange, and learn which direction the developers should take to meet rapidly-evolving user needs. While there is no "standard" recipe on how to conduct an event, we can tell you about time-proven, battle-tested event formats that have been conducted annually for the past decade. Our hope is to convince early-career researchers and junior RSEs that such events are not only beneficial to their career development and to the software, but also that the event organization is within their reach in terms of financing and effort.

In this work, we refer to "event" to describe any space for a software community to meet and form meaningful connections. We specifically concern ourselves with events where users and developers are the main target audience. We focus on on-site formats and will keep our feedback on online and hybrid formats brief, since those have been discussed at length in the literature [PK21, Oru21, MLD+21, GFN+10, MGH+20, AEGM20]. Resources on on-site formats are less abundant and tend to focus on a single (and often large) event; we can mention short guides [Pot83, BDC+15, CGJB08] as well as the book by Devney [Dev01]. Although the best practices outlined in the present work do not significantly deviate from these sources, we explore aspects that are specific to software-centered events, and provide insights to better understand the RSE role and impact on communities [LMB+22]. We also note the German Aerospace Center organizes annual RSE workshops for community building and knowledge exchange [SHMS19], and has recently taken steps to quantify the impact of these events [DS25]. However, the present work isn't attempting to carry out systematic research on event organization, and we will refer the reader to the relevant literature when available.

We reflect on experiences from three event series organized by different departments that independently converged to the same overall structure thanks to community feedback. All three events are targeting the distributed communities of the departments' respective simulation software projects, and are organized by academic teams with limited resources. The techniques we employ to prepare and run our events are surprisingly similar, and our approach to event design can be summarized as *learn–create–connect*:

Learn Lectures provide an introduction to the science and open problems in our fields, as well as an overview of the mathematical principles and simulation algorithms used in our software. In hands-on sessions tutored by software experts, participants learn how to reproduce published results using the software and hone their coding skills. Research talks and poster sessions show current applications of the software.

Create Users and developers can join world cafés [And12, SKHK22] and birds-of-a-feather sessions [Nar09] to draft white papers, find collaboration opportunities, or contribute to software governance. In coding sessions, users and developers can work together on the continuous improvement of the software, for example, to include a new feature or implement a bug fix.

Connect Software meetings are a place where users can get guidance on their specific research projects from the combined expertise of researchers in their field and software developers. It is also a place for developers to inform users about upcoming features and receive feedback to direct future developments. Social events allow people to network and join new collaborations.

2 Success stories

The following sections will focus on three events that started as grassroots efforts and have been organized on an annual or semi-annual basis for several iterations in Stuttgart: the ESPResSo summer school, the preCICE workshop, and the DuMu^x course. This longevity allows us to reflect on the factors that contribute to their success, and the lessons learned along the way.

All of these events have been organized (at least partially) at the University of Stuttgart, by different groups. Although these events grew isolated from each other, the organizers later discovered the overlap in the context of the local RSE community chapter [FHH+20], which led to this collaborative work. These efforts are often sponsored by the Stuttgart Center for Simulation Science – Cluster of Excellence EXC 2075 "Data-Integrated Simulation Science (SimTech)"[1].

2.1 ESPResSo summer school

ESPResSo is an open-source simulation package that combines molecular dynamics and fluid dynamics to simulate soft matter at different scales, with applications in process engineering, responsive materials design, polymer science, charged and magnetic soft matter, biophysics, and nanomaterials. It is developed mainly at the University of Stuttgart, with occasional contributions from collaborating groups, as well as from power users in the ESPResSo community who are not formally affiliated with the ESPResSo home institution.

The goal of the ESPResSo summer school, held annually since 2010, is to provide a platform to train newcomers to the soft matter community, upskill experienced users in adopting new software features, advance the state of the software through coding sprints, and learn about new applications of the software in our field of research.

The school is organized as a five-day event with four half-days of scientific lectures in the morning, four half-days of hands-on sessions in a computer lab in the afternoon, and one half-day of research talks (Table 2). In parallel to the hands-on session, impromptu birds-of-a-feather meetings are flexibly scheduled between invited speakers and available Ph.D. students to explore scientific collaborations, discuss recently published papers, implement new features or fix bugs in coding sprints, and plan future meetups. The event format therefore encourages full attendance for speakers and participants. It is part of several University of Stuttgart M.Sc. curricula[2] and yields ECTS credit points. Many collaborating groups send their newly hired Ph.D. students to the school for rapid onboarding with the software and networking with the developers.

The summer school is currently carried out as a CECAM Flagship School, located at the home institution in Stuttgart, and hosted by the Soft Matter and Statistical Mechanics[3] CECAM node, a consortium formed by the University of Stuttgart, the Technical University of Darmstadt, the University of Mainz, and the Max-Planck-Institute for Polymer Research Mainz, Germany. Like all other flagship schools, the event is primarily science-oriented. In this case, the focus is on soft matter physics, algorithms, and molecular simulation techniques. Yet, hands-on sessions are mostly done with ESPResSo. One half-day is often reserved for codes that use ESPResSo as a library, or that ESPResSo uses to provide specific algorithms or features.

[1] https://www.simtech.uni-stuttgart.de/exc/
[2] https://campus.uni-stuttgart.de/cusonline/pl/ui/$ctx/wbLv.wbShowLVDetail?pStpSpNr=392232
[3] https://www.cecam.org/cecam-de-smsm

Participation fees are fully waived thanks to an RSE grant [KMMK24] and SimTech. While the basic structure of the school is well established and proven, different topics are emphasized each year[4], such as systematic coarse-graining and machine learning (2025), multi-scale simulations (2024), or energy materials (2023) to name a few. Several people attend the school repeatedly, indicating that enough novelty is provided in new installments. The broad scope of the ESPResSo package results in a sizable audience, typically more than 40 participants on-site. Attendees come from all stages of their academic or professional career, with home institutions mostly located in Europe (Figure 1). Germany's overrepresentation is due to M.Sc. and Ph.D. students from Stuttgart, and speakers and tutors from the software's home institution.

The poster session is preceded by a round of lightning talks, during which every presenter has 1 min to convince the audience to visit their poster, with the help of a single slide. There are more opportunities for one-to-one informal discussions between participants, the speakers, and software developers, thanks to the 30 min-long coffee breaks and the conference dinner.

A book of abstracts of the lectures, scientific talks and posters is published under an open-source license on Zenodo to make contributions citable. Teaching material is available online: slides are hosted on the CECAM platform, recorded lectures are available on YouTube[5], and Jupyter notebooks [KRP+16] are remotely executable on the Binder platform [PBF+18].

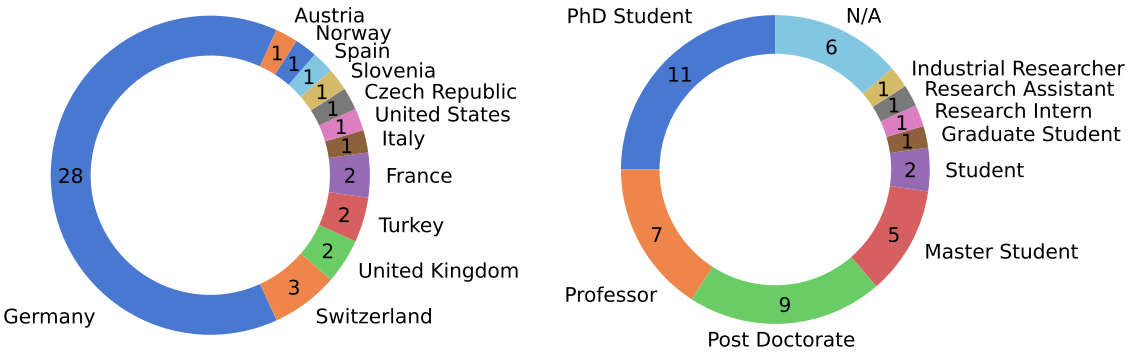

Figure 1: Demographics of the 44 attendees (participants + speakers + organizers) of the 2024 ESPResSo summer school. Left: home institution country. Right: role in academia and industry.

2.2 preCICE workshop

preCICE is an open-source coupling library for partitioned multi-physics simulations, with applications in aeroelasticity, biomechanics, reactor safety, climate simulations, and more. It is developed at the University of Stuttgart and the Technical University of Munich, with occasional external contributions on GitHub by collaborators, users, or sometimes contributors without any clear connection to the project. The community meets online in the preCICE forum[6], which

[4] https://espressomd.org/wordpress/community-and-support/espresso-summer-school/#past-summer-schools
[5] https://www.youtube.com/channel/UC6yzqhq2KrT-aDhPjcL-VNw
[6] https://precice.discourse.group/

started in 2019 and currently has 600+ members. Known users and contributors are based primarily in Germany and the EU, with several users also based in China, USA, Japan, UK, India, and more.

The preCICE Workshop[7] is running annually since 2020 and is aimed at potential, new, and experienced users, and with a schedule that allows partial attendance (Table 3). It complements the preCICE Coding Days, a more frequent, informal event aimed specifically at developers.

This week-long workshop starts with a hands-on training course for new users, which is regularly updated and extended to be more appealing to returning attendees. The main part of the workshop starts with a round of introductions, in which every participant gets one slide to talk about their research, optionally referring to posts in the preCICE forum for more details. The schedule continues with user and developer talks and posters on methods, applications, and project updates, as well as interactive components (notably a world café [And12, SKHK22]) to discuss broader issues, upcoming features, or future directions. The event concludes with hands-on user support sessions, where developers work together with users to resolve issues and explore potential collaborations. An additional support session is scheduled for a few weeks after the workshop, to encourage continuation of the work. Talks are recorded and gradually published on YouTube[8], while the rest of the content is internally documented and distributed.

Planning the event starts one year ahead, with finding a date and potential venue. The date is then announced at the end of the running workshop and advertised on all channels (including the preCICE forum, LinkedIn, various mailing lists, and direct contacts). Most of the iterations of the workshop have been on-site in German universities and supported by local scientific and science-supporting organizations and user groups, such as SimTech and the Informatik-Forum Stuttgart[9]. The planning involves the complete preCICE team, who collects and evaluates scientific contributions from the community and designs the program. A public organizing guide provides more details on how to organize a preCICE Workshop[10].

Financing of the workshop is based primarily on registration fees, with varying additional funding every year, depending on availability. Ticket prices differ for academia and industry, including or excluding the training course component, and early/late registration. Note that a workshop involves different kinds of costs (catering, travel grants, advertising material), which might not be possible to cover by all different kinds of available funding. A registration fee provides a sustainable funding scheme in the long run. The fee collection is typically managed by the local organization supporting the workshop. No special event management system is currently used, besides a static webpage on the project's website and conventional survey forms.

Most of the participants come from academic institutions in Germany, while further research institutions and a few industries are also represented. In 2024, 27 out of 37 participants (73%) worked in Germany, and further countries included China, France, India, Italy, South Korea, Sweden, and The Netherlands. 5 out of 37 participants (14%) worked for a non-publicly funded organization. In 2023, the share of participants from industry was 2 out of 49 (4%), while again most of the participants worked in Germany (27 out of 49, or 55%). In both iterations, the vast majority of participants were Ph.D. students and post-doctoral researchers.

[7] https://precice.org/precice-workshop.html
[8] https://www.youtube.com/c/preCICECoupling/
[9] https://www.informatik-forum.org
[10] https://precice.org/precice-workshop-organizing.html

2.3 DuMu^x course

DuMu^x is an open-source simulator for flow and transport processes in porous media, based on the Distributed and Unified Numerics Environment (DUNE)[11]. Its core developers and resources are tightly coupled to two major German research consortia: the Collaborative Research Center 1313 (SFB 1313)[12] and the Cluster of Excellence SimTech (EXC 2075 SimTech)[13], as well as the Department of Hydromechanics and Modelling of Hydrosystems. This institutional connection is reflected in the community, where most users have ties to either the SFB 1313, SimTech, or the department. Consequently, DuMu^x is primarily used in Germany, with worldwide users mainly through collaborations with these institutions.

The DuMu^x course participants demographics is similar to that of the ESPResSo summer school, with the majority originating from the aforementioned German research networks, while international attendees typically arrive through established collaborative partnerships.

The course is organized as a three-day training event, comprising six half-days that combine theoretical lectures with hands-on sessions. The event consistently attracts 15–20 participants per year, while being limited to 20 from the host side. Most of the participants are within close reach of the developers, mainly within the SFB 1313 and the EXC 2075 SimTech. The first instances of the course have been run in 2018 and, in a short version, in 2019. After the pandemic, the course has been offered annually since 2023, with continuous refinements based on participant feedback.

The first five half-days follow a progression starting with basics and building toward advanced concepts. The ultimate goal is to enable participants to create their own applications by the end of the course. This is achieved through a step-by-step approach: starting with how to set up a DuMu^x application, then moving on to making runtime changes such as simulation parameters and different grid resolutions. As participants get more comfortable with the software, they move on to modify encapsulated parts of the source code, such as boundary conditions. Finally, they learn to alter the structure of the source code itself. This progression guides participants from using DuMu^x as a black-box application to get an understanding of its internal architecture. The last half-day focuses on user-specific problems, where participants work on their research questions. Participants without a definite use case can work with readily available applications from the SFB 1313 showcasing DuMu^x capabilities. Most DuMu^x developers remain on-site throughout the 3-day event, providing continuous support.

The 2023 course was offered free to all participants regardless of affiliation, funded entirely by the SFB 1313. In 2024, a three-tier payment model was introduced: free access for SFB 1313 and SimTech affiliates, a 150 € fee for academic participants, and a 500 € fee for industry partners. This model maintains accessibility for the core research community while providing sustainable funding for course development.

Preparation follows a structured timeline, with comprehensive checklists for instructors and tailored pre-course materials for participants. Participant skills are analyzed across four domains (command-line interface, Git, C++, and DuMu^x) to customize content delivery. Pre-course materials include curated resources on C++ programming concepts, version control, and command-

[11] https://www.dune-project.org/
[12] https://www.sfb1313.uni-stuttgart.de/
[13] https://www.simtech.uni-stuttgart.de/exc/

line interfaces. However, participant feedback revealed these resources were often overlooked, resulting in prerequisite knowledge gaps. Evaluations consistently identified C++ proficiency as the primary obstacle to course progression.

In addition, participants were asked to prepare flash presentations which were held on the first two days. This allowed instructors to consider each problem in advance and provide targeted help during the final half-day. Furthermore, these presentations enabled participants to discover others working on similar problems, facilitating potential collaboration during and after the course. Course materials are hosted on a dedicated GitLab repository[14], with installation scripts to facilitate setup across different operating systems. While this repository is permanently available, the on-site course provides supervised instruction specifically designed to elevate participants beyond self-study of the repository materials.

In 2024, participants rated the overall course quality as "Very good" to "Excellent" (average 4.6/5), with 91% indicating that they would recommend it to colleagues. Survey results highlighted several important findings: participants particularly valued the flash presentation format for networking opportunities; they reported significantly improved confidence in adapting existing models (average rating 3.6/5) but less confidence in creating entirely new models (3.2/5). The goal has therefore been partially reached, but understanding an open-source grown codebase in three days is obviously an ambitious goal. The most frequently requested improvement was additional time dedicated to working on personal problems with expert guidance, which can be attributed more to a wish for an advanced course.

3 Organizational aspects

3.1 Financing options

Events can be supported by research funding agencies, such as the German Research Foundation (DFG) as part of RSE grants [KMMK24] via forms 52.06 "Project-Specific Workshops" [DFG22] and 52.07 "Module Public Relations" [DFG11], or indirectly through the DFG Overhead Allowance. Local organizations and collaborative research centers may be able to offer small grants to cover travel costs or catering. Support can also be sought from field-specific funding programs, such as the annual CECAM Flagship program and the semi-regular CECAM joint programs[15], or from programming language-specific grants, notably numFOCUS[16] for Python software. Co-location of the event within a larger conference can also help reduce the administrative burden and operational costs, since the venue is already selected and a registration system is provided, with tickets for the full event or just for the co-located event. For illustration purposes, the ESPResSo summer school costs are summarized in Table 1.

Another funding option is charging a conference fee. Unless the academic institution hosting the event is a business entity, organizers have to find a third party to handle conference fees and sales tax on behalf of the institution, pay for costs not covered by other funding sources, as well as manage secure payment options.

[14] https://git.iws.uni-stuttgart.de/dumux-repositories/dumux-course
[15] https://www.cecam.org/#cecam-news2
[16] https://numfocus.org/programs/small-development-grants

Item	Cost
catering: lunch, coffee breaks, soft drinks, barbecue	2925 €
invited speakers' travel and accommodation costs	2930 €
conference dinner	470 €
student contracts	320 €
supplies and software licenses	100 €
total	6745 €

Table 1: Operational expenses of the 2023 ESPResSo summer school (44 participants).

3.2 Advertising

The specialized codes represented in a software-centric event have, by definition, a limited user community. Therefore, the pool of potential participants is also limited, but typically highly overlapping with existing user groups. Attaching to a domain or local organization, such as CECAM or SimTech, comes with additional advertising support through their channels. Besides these channels, most effective methods seem to be prominent display on the website of the project/code, related talks at other conferences, as well as word of mouth and targeted emails to collaborators and relevant mailing lists (local, project-related, or domain-specific). Posts on social media (such as LinkedIn, BlueSky, or YouTube) are important to attract new users in the long run, but few participants seem to discover the event first via social media.

Early advertising is very important: a "save the date" as soon as this has been planned can help the target audience keep the event on their radar. Reminders close to the submission/registration deadline are also expected. Academic culture might discourage researchers from advertising. Yet, reaching out to a diverse audience and securing a critical mass of participants are essential to the success of an event. In addition, events increase exposure to potential contributors who can maintain and develop the software in the long run. Since these events are also typically not-for-profit, open to everyone, and educate on scientific topics and open-source software profiting everyone, there is little reason for such hesitation.

3.3 Venue

The ESPResSo summer school and DuMu^x course are organized at their respective home institutions in Stuttgart. The preCICE workshop has been organized in Stuttgart and Munich, home institutions of the developers. This decision greatly simplifies logistics, since all the infrastructure is already available, organizers are familiar with the venue and facilities, and the teaching staff does not need to travel

Events can be "co-located" within another event in order to bring together different communities and decrease the organizational costs. The DuMu^x course was co-located at InterPore2019 in Valencia, Spain. The ESPResSo summer school reserves one half-day for other software teams to present their code. Alternatively, such events can be co-organized by user groups (with the preCICE workshop 2025 as an example), taking a significant part of the organizational workload from the development team, which can focus on the scientific aspects of the event planning.

3.4 On-site formats

On-site events are usually straightforward to organize in an academic setting, since they require the same logistics as for regular university courses. Teaching staff can rely on their practical experience to solve most problems, and when the event takes place at the home institution, troubleshooting technical issues with the computer lab or conferencing system is easy.

When designing the event program, it is often convenient to use "half-day" as the unit of time, as it allows flexible scheduling of arrival/departure times. The preCICE workshop uses a staggered schedule (Table 3) to make travel plans convenient for all participants, regardless of their mode of attendance. The ESPResSo summer school uses a fixed schedule (Table 2) to facilitate the organization of parallel sessions in the afternoon, since most of the speakers are available during hands-on sessions. The DuMu^x course has a flexible schedule (Table 4).

3.5 Online and hybrid formats

While on-site formats are still commonplace, fully online events have many benefits. In particular, they are more inclusive since they avoid costs, time, and restrictions associated with traveling, and, depending on the format, they can be easier to organize. However, online events also come with their own challenges, in particular when they aim to include participants from different time zones. Verbal interaction between participants and speakers is limited and requires additional infrastructure support. Hands-on sessions, poster sessions, and social events need to be completely re-designed for online attendees. However, online events do bring the opportunity for continuous written communication during the event, a feature that is now added to many on-site events via additional communication channels.

The preCICE workshop was held online in 2021–2022. The format focused on interactions and was based on pre-recorded content and synchronous interactive sessions. Pre-recorded talks were streamed (to reduce technical issues), with the speaker present and answering questions in the chat and during the Q&A session. Participants in the training sessions were distributed in breakout rooms, sharing a screen and using step-by-step instructions in text and video. The user support sessions were similarly implemented in breakout rooms. This online format was positively accepted by the participants, attracted a larger audience, and required less logistical preparation. While the scientific interaction was adequate, on-site events are still preferred for further scientific and social interaction. A hybrid preCICE workshop was never tried; instead, shorter online events at different times of the year offered opportunities for members of the community from farther away to join the discussion.

The ESPResSo summer school experimented with an online format during 2020–2021 and a hybrid format during 2022–2023, enjoying a larger audience, but reverted to the fully on-site format in 2024 due in part to online participants finding it challenging to form meaningful connections. Another challenge was the increased labor costs for setting up the virtual space. The morning lectures were recorded, and the raw unedited footage was uploaded to a file hosting service so that participants in time zones far behind central European time could watch it before the hands-on sessions started in their time zone. Multiple online rooms were created for each hands-on session, with 5 participants per tutor, where participants would take turns solving the coding exercises. This *synchronous* teaching format is fundamentally different [FRM22] from a

massive open online course (MOOC), which is almost always *asynchronous*, and many online participants joined the ESPResSo summer school with the wrong expectations.

3.6 Hands-on training courses

Training courses can take several forms: follow-along lectures with live demos, lectures with separate exercises (ESPResSo summer schools), or inverted classrooms [AD15] (preCICE workshops). In our experience, the follow-along lectures format is prone to failure, because technical difficulties during live demos or participants' understanding issues in the middle of a session can compromise the complete session. The lectures + exercises format works well for discussing modeling aspects in detail before implementing them in code. The inverted classroom format allows each participant to proceed at their own pace and is very easy to port to online formats and other conferences.

A common challenge in hands-on training courses is the infrastructure. A computer lab with pre-installed software is ideal, but not always available. While it is common to ask participants to prepare their own laptop, when an installation verification step is missing, coding sessions can be delayed by participants sorting out installation issues. To make preparation minimal, organizers might distribute a container or virtual machine image, bootable USB sticks, or access credentials to a remote system. In a follow-up step, participants can get support installing the software on their own system, but this is an opportunity that not enough participants have used over the years.

Virtual machine images can be prepared and distributed, e.g., with Vagrant and VirtualBox (see, for example, the preCICE demo VM[17]). Bootable USB images can be prepared, e.g., with Cubic[18]. Both options allow for a complete desktop environment but come with system compatibility restrictions. Bootable USB sticks are a better solution for courses in which participants cannot get preparation information in time (e.g., as offerings in larger conferences). Ease of setup, performance, storage and memory requirements, familiarity with the keyboard layout and tools, as well as access to own system and files are important factors to consider. If network availability at the venue can be ensured, a secure shell or remote desktop connection to a managed system (e.g., cloud VM instances or HPC cluster) is the most reliable and compatible solution. However, in case of network issues, the complete course can fail. As none of these solutions are perfect, the preCICE team also typically prepares a few shared laptops as a fallback solution.

The ESPResSo team relies on Jupyter notebooks [KRP+16] that are remotely executed on the Binder platform [PBF+18] and regularly tested in nightly builds. This provides a fallback solution during the event and enables our community to run the exercises again after the event, directly in their web browser[19].

3.7 Networking

For long-term impact, it is important that participants network with each other. Although this can be achieved within the usual breaks during the conference, scheduling explicit networking time can be important as well. This can have the form of a world café [And12, SKHK22]

[17] https://precice.org/installation-vm.html
[18] https://github.com/PJ-Singh-001/Cubic
[19] https://mybinder.org/v2/gh/jngrad/espresso-binder/main

(rotating small-group discussions with pre-defined topics), a poster session, a scientific speed-dating session[20], a conference dinner, or other social events.

The ESPResSo summer school organizes a scientific speed dating session on the first day to establish initial connections. Everyone is randomly paired and asked to introduce themselves and their research project to each other in 3 min rounds, and then move to the next partner in line to repeat the cycle. After 1 h, everybody has met half of the attendees.

Introduction sessions with lightning talks, writing in a dedicated forum thread (especially for online events), and short virtual ice-breaking sessions [DL11] (for online events, with questions related to the event scientific content) can have a similar effect. Although event organizers rely on various techniques to facilitate interaction between participants[21], the literature on the impact of these techniques in such a context seems to be lacking.

3.8 Archiving

Organizers should publish the teaching material in online repositories, so that participants can later go back to the material and re-do the exercises at their own pace. Lecture slides can be uploaded to a persistent repository such as Zenodo. Recorded lectures can be published on video distribution platforms, as is the case with the YouTube channels of preCICE[22] and ESPResSo[23]. In the case of talk recordings, it is important to capture the slides and speakers in separate streams, which typically requires special recording infrastructure. When applicable, provide the hands-on session material as executable documents with a full software bill of materials, as outlined in section 3.6. The teaching material can also be made available in annotated datasets on the E-CAM training portal [E-C] according to the FAIR principles [WDA+16], and served on the Lhumos training portal [BB24]. Workshop post-proceedings can be organized as well, but this requires significant additional effort and is not typically expected from such workshops.

4 Discussion

The three event series discussed in this work have grown as grassroots efforts, independently of each other. As such, we have only presented experiences from organizing and improving these over several iterations. Looking at the common experiences, we find differences and common patterns, from which we try to extract guidelines in Section 5. Where possible, we compare these events to existing events from larger simulation software communities, such as the OpenFOAM Workshop[24], the SU2 Conference[25], or the deal.II Users and Developers Workshop[26], which we will refer to as "reference events".

An overview of the schedule of each event (Subsection 7.1) shows the different emphasis of each event series. All of these events offer components to learn, to create, and to connect.

[20] https://www.nature.com/scitable/blog/conferencecast/getting_together_science_speed_dating/
[21] See, for example, https://www.seedsforchange.org.uk/tools
[22] https://www.youtube.com/c/preCICECoupling/
[23] https://www.youtube.com/channel/UC6yzqhq2KrT-aDhPjcL-VNw
[24] http://openfoamworkshop.org/
[25] https://su2foundation.org/su2conference2025/
[26] https://dealii.org/workshop-2024/

The ESPResSo summer school and the DuMu^x course put a stronger focus on training (with lectures and hands-on parts), while the preCICE workshop splits the time between training, classical conference talks, and further interactive elements. Looking at other events from the wider community, all three are smaller and include more training and interactive elements (and fewer research talks) than our reference events. This emphasis on interactivity and hands-on sessions is essential to support our community building efforts. All three event series involve getting participants familiar with the software as a simulation environment, and with some of its internal structure, such that they can later contribute to the software development.

Being organized by teams with limited resources, our events also have a limited number of participants and only a single track, in contrast to events of larger communities, such as the OpenFOAM Workshop. While the ESPResSo summer school benefits from a fully integrated digital and organizational infrastructure for organizing the event, the preCICE workshop and DuMu^x course handle finances, registrations, and further organizational aspects directly, which is a common logistical challenge for small academic events.

Besides their immediate impact on the respective software project communities, and despite their small size, these events have an impact on a wider community. They all publish and disseminate a large part of their material, as is common in communities that form around open-source software projects. Besides publishing, preCICE in particular has an impact on a wider community, as by design it interfaces communities of other simulation fields and codes.

5 Ten simple rules

Looking at the common challenges our event series have faced and the solutions that worked, we define guidelines that could help the wider RSE community to organize similar events. In keeping with the tradition of top tens in similar technical papers [JSM+22, AEGM20, GFN+10, CGJB08], here are our "simple rules" for organizing successful software community events.

5.1 Define the goals and target audience of the event

When planning an event, it is important to clearly define its goals, and balance the scientific, software, and social content of the event in a way that aligns well with those goals. Is the event addressed to developers, to new users, or to both? If the latter, how can both groups feel welcome? Is this primarily a training, a development, or a results event? Are classical conference talks enough, or are further elements needed? Should the event be self-contained, or open-ended with an invitation to start new collaborations and/or join a follow-up meetup? The name of such an event might also directly imply some of these goals. Communicate these clearly to attract the right audience.

5.2 Make the event attractive to everyone in the target audience

Design the program to attract people of different career stages and proficiency levels. The preCICE workshop and the ESPResSo summer school follow two different schedule designs with this consideration, as shown in section 7.1. The preCICE workshop starts with training

for new users, continues with talks aimed at everyone, and closes with interactive support sessions, allowing returning attendees to invest less time. The ESPResSo summer school schedule includes birds-of-a-feather meetings for developers in parallel to introductory hands-on sessions for newcomers, inviting experienced users to participate in the complete event.

Besides the training offerings, the opportunity to present one's own work also makes the event attractive. The call for contributions (talks or posters) should put emphasis on the scientific topics of the event rather than the software, so that people new to the software can also contribute. Research made with other codes helps organizers and software developers discover relevant methods that would be worth supporting in their software. Likewise, posters on planned work let software developers discover new trends in their community and let participants get guidance early on in their projects. The objective is for everyone to actively engage in the event, no matter their scientific background and career stage.

5.3 Foster scientific exchange and collaborations

The event formats described in this document are fundamentally different from user training sessions and MOOCs, which are designed to transfer knowledge from the teachers to the students. Software-centered events are meant to exchange ideas in both directions. Attendees should feel like they are actively contributing to the event. Consider scheduling a poster session with lightning talks, a scientific speed dating session, a world café, or birds-of-a-feather meetings. Long coffee breaks help participants approach speakers and software developers to get expert advice on their specific simulation projects and start in-depth discussions about cutting-edge algorithms and emerging computing paradigms.

5.4 Make the event valuable even to people who cannot attend

Making the teaching material publicly available for self-study at the end of the event helps reach a wider audience. Uploading the recorded lectures and auxiliary files to a data repository lets the community benefit from the main takeaways, and gives speakers a way to cite their contribution, which can be very much appreciated by early-career researchers. Refer to section 3.8 for more details.

For interactive sessions, designate a note taker to keep a record of the discussion, and collaborate on these notes with the participants. Lock the notes after the event ends and transfer the information into a citable document. Offer a platform for users to join the software community and form meaningful connections after the event, such as a forum or a mailing list.

5.5 Sort out financing options early

If collecting a registration fee is necessary, finding a supporting organization that can collect this might be a long process that should be completed before ticket prices are announced and before the registration opens. Estimating expected costs depends on the scale of the event, driven mainly by catering offers. Use worst-case estimates when requesting catering offers and calculating ticket prices, as it is often easier to scale up than to scale down. Sources of external funding are rare and highly competitive; see section 3.1 for an overview of costs and a selection of grant

programs. Some organizations might be willing to support the event indirectly through travel grants for participants who would otherwise be unable to finance their travel plans.

5.6 Provide all information upfront

Although some information about the event is very important for early travel planning, it is easy to forget or unnecessarily postpone publishing it. In addition to a "save the date" announcement, communicate a preliminary rough schedule (including at least start and end time) as early as possible on the event website, as this is often necessary to apply for a business trip, even if this is subject to change. Clear information about any participation fee and included meal slots is also important for reimbursement procedures. Further information that is useful is a list of accommodation options, visa-related matters, location/venue information, as well as an e-mail address for inquiries. The more questions are answered on the event website, the fewer the inquiry e-mails. A few days before the event, send an e-mail with a summary of important information, including information on reaching the venue: this can prove particularly helpful while traveling.

5.7 Find an online platform to manage applications and marketing

Managing registrations via e-mail or other conventional tools can be overwhelming, even though still manageable for small events. Many event management platforms can simplify the process and help reach a wider audience. These platforms usually combine two components: a content management system (CMS), and an event management system (EMS). The latter can handle participant registration and invoicing, event accounting, abstract submission, electronic material upload, timetable generation, book of abstracts generation, and automated mailing. Examples of such platforms include Indico[27] (a self-hosted solution for academic networks, such as the HIFIS Event Management Platform[28]), Sciencesconf[29], EasyChair[30], or eventbrite[31]. The ESPResSo summer school uses the field-specific CECAM[32] platform, which provides a CMS and an EMS, while the preCICE workshop and DuMu^x course use a combination of conventional tools, including survey tools and the systems of the respective local communities supporting the events.

5.8 Take cybersecurity seriously

There are various security risks involved before and during both online and onsite events. Most prominently, events that provide accommodation should make participants aware of the "conference hotel phishing scam"[Smi20]. One solution involves asking participants to initiate contact with the hotel themselves, using a coupon or code to book one of the hotel rooms reserved for the event. Provide a clear communication channel for people to double-check with the organizers the legitimacy of suspicious electronic communications, for example by setting up an official

[27] https://getindico.io
[28] https://events.hifis.net
[29] https://www.sciencesconf.org/en/
[30] https://easychair.org/
[31] https://www.eventbrite.com
[32] https://www.cecam.org/#cecam-event

contact address for the event. Besides this event-specific attack, consult with the local IT department before setting up a registration page (which should offer encrypted connection via HTTPS), and organize the setup of guest accounts for the venue network and for any computing systems used for training. Get up-to-date with relevant regulations, such as the General Data Protection Regulation (GDPR), especially when storing personal e-mail addresses or dietary preferences. When taking pictures of the participants for promotional material and social media, it is essential to make participants sign a waiver release form.

5.9 Collect and act on feedback

Collecting feedback is necessary to improve future iterations of the event. Design a feedback form with targeted questions that yields actionable insights. In closed-ended questions, ask how participants liked specific parts of the event that can easily be changed. Ask how often people would come back to such an event, how they found out about it, and where else they would expect to see it advertised. In open-ended questions, ask what people enjoyed, what would make them return, and what they would like to see added/removed/improved. Send the feedback form on the last day of the event, so that participants can complete it while their experience is still fresh. Analyze the results internally and include findings in a post-event blog post, as well as in the webpage of the next iteration of the event. Refer to these results when planning the next iteration.

5.10 Start small and work your way up

The events presented in this document grew organically over the years and took several iterations to reach their current attendance rates. Start with local user meetings and progressively raise the stakes. First, invite external collaborators to give scientific talks about novel applications of the software, and open the venue to the public (use the news feed of the institute homepage and send an invitation to the graduate school mailing list). Then, include a user training session and advertise to external collaborators. Explore the possibility to meet the software community at another conference, for example in a birds-of-a-feather meeting, or with satellite meeting attached to the conference. Collect statistics (number of participants) and outcomes (white paper, collaboration agreements) in publicly available documents (e.g., a blog post or a new post on the home institution home page) that can later be linked to when applying for funding at institutions that financially support software workshops.

6 Conclusion

Annual workshops and schools organized in Stuttgart allow us to meet directly with our community, learn their needs and showcase recent developments with the codes. They also provide us with an opportunity to work together with prospective, new, or advanced users to foster collaborations or help them integrate their contributions into the respective codebases. In this short guide, we distilled several lessons learned that made our events successful and offered pointers to more specialized resources where relevant. These events are small enough to be planned by a small team over a few weeks and with a budget that can be partially or fully covered by existing

funding or a registration fee comparable to many other academic events. We believe that organizing such an event is manageable with reasonable effort for early-career researchers and junior RSEs, and that it can play a catalytic role in the development of a research software community.

Acknowledgements: J.-N.G., R.W. and C.H. acknowledge funding by the European Union; this work has received funding from the European High Performance Computing Joint Undertaking (JU) and countries participating in the project under Grant Agreement No. 101093169. The contributions of J.-N.G., R.W. and C.H. were co-funded by the Federal Ministry of Education and Research (Bundesministeriums für Bildung und Forschung, BMBF) under the funding code 16HPC095. The responsibility for the content of this publication lies with the author(s). G.C. and B.U. acknowledge funding from the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) under project number 528693298. C.H. acknowledges funding from the DFG under project number 391126171. G.C., B.U., B.F., L.K., C.H. and R.W. acknowledge funding from Germany's Excellence Strategy – EXC 2075 under project number 390740016, and support from the Stuttgart Center for Simulation Science (SimTech). B.F. would also like to thank the Federal Government and the Heads of Government of the Länder, as well as the Joint Science Conference (GWK), for their initiative within the framework of the NFDI4Ing consortium (DFG project number 442146713).

7 Appendix

7.1 Schedules

Mon	Tue	Wed	Thu	Fri
Lectures	Lectures	Lectures	Lectures	Talks
Lectures	Lectures	Lectures	Lectures	Talks
Hands-on	Hands-on	Hands-on	Hands-on	
Hands-on	Hands-on	Hands-on	Hands-on	
Social	Poster session		Social	

Table 2: Typical ESPResSo summer school schedule. From 08:00 to 12:30, 3 h of lectures (blue blocks) and scientific talks (orange blocks) are organized in 4×45 min or 2×90 min slots with a 30 min coffee break (thin gray blocks), followed by a 90 min lunch break (thick grey blocks). From 14:00 to 17:00, 3 h of hands-on sessions (green blocks) are organized in 2×90 min slots with a 30 min coffee break. From 17:00 to 20:00, social events (pink blocks) and a poster session (brown block) take place.

Mon	Tue	Wed	Thu	Fri
	Training	Training	Talks	Support
Training	Training	Talks	Talks	Support
Training	Training	Talks	World Café	Support
Social	Social	Social	Poster session	

Table 3: Typical preCICE workshop schedule. From 09:00 to 12:00, 3 h of hands-on training (blue blocks), user and developer talks (orange blocks) or user support sessions (green blocks) are scheduled depending on the day, followed by a 60 min lunch break (gray blocks). From 13:00 to 17:30, this pattern repeats for 2×2 h, with a 30 min coffee break (gray blocks). Time is reserved for social events in the evening from 19:00 to 21:00 and during the week, and for the world café and poster session (brown blocks). The schedule is split in two parts: training and main workshop. Both parts start in the afternoon, to allow participants from nearby locations to travel on the same day.

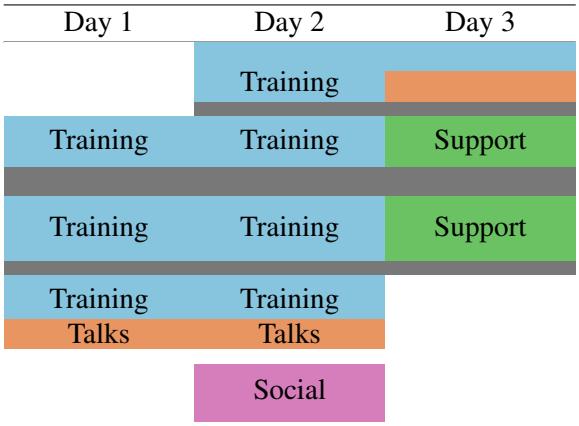

Table 4: Typical DuMu^x workshop schedule. Hands-on sessions (blue blocks) train software users. Talks (orange blocks) allow participants to present their individual challenges and developers to showcase applications related to the SFB 1313. Support sessions (green blocks) address individual problems and exercises. Gray blocks represent coffee breaks and lunch breaks.

Bibliography

[AD15] L. Abeysekera, P. Dawson. Motivation and cognitive load in the flipped classroom: definition, rationale and a call for research. *Higher Education Research & Development* 34(1):1–14, 2015.
doi:10.1080/07294360.2014.934336

[AEGM20] A. Arnal, I. Epifanio, P. Gregori, V. Martínez. Ten Simple Rules for organizing a non–real-time web conference. *PLOS Computational Biology* 16(3):1–13, Mar. 2020.
doi:10.1371/journal.pcbi.1007667

[And12] L. Anderson. Use the World Café concept to create an interactive learning environment. Cardiff University, Cardiff, United Kingdom, 2012. ISBN: 978-1-907019-44-9.
https://www.cardiff.ac.uk/__data/assets/pdf_file/0019/1165015/How_to_World_Cafe.pdf

[BB24] S. Bonella, R. Bendinelli. Learning hub for modeling and simulation. In *Get to know Lhumos*. CECAM, Lausanne, Switzerland, Jan. 2024.
https://alpha.lhumos.org/player/6/0/65a53f9de4b08f2db4344741/65b2180ae4b08f2db4352ab7

[BDC+15] A. Budd, H. Dinkel, M. Corpas, J. C. Fuller, L. Rubinat, D. P. Devos, P. H. Khoueiry, K. U. Förstner, F. Georgatos, F. Rowland, M. Sharan, J. X. Binder, T. Grace, K. Traphagen, A. Gristwood, N. T. Wood. Ten simple rules for organizing an unconference. *PLOS Computational Biology* 11(1):1–8, Jan. 2015.
doi:10.1371/journal.pcbi.1003905

[CGJB08] M. Corpas, N. Gehlenborg, S. C. Janga, P. E. Bourne. Ten simple rules for organizing a scientific meeting. *PLOS Computational Biology* 4(6):1–3, June 2008. doi:10.1371/journal.pcbi.1000080

[Dev01] D. C. Devney. *Organizing special events and conferences: a practical guide for busy volunteers and staff*. Pineapple Press, revised 1st edition, 2001. ISBN: 1-56164-217-7.

[DFG11] DFG. Module public relations. DFG form 52.07 [10/11], Deutsche Forschungsgemeinschaft, Bonn, Germany, Oct. 2011. https://www.dfg.de/de/formulare-52-07-246742

[DFG22] DFG. Module project-specific workshops. DFG form 52.06 [09/22], Deutsche Forschungsgemeinschaft, Bonn, Germany, Sept. 2022. https://www.dfg.de/de/formulare-52-06-246740

[DL11] S. Doctoroff Landay. Not another icebreaker! *eLearn* 2011(3), Mar. 2011. doi:10.1145/1966297.1966301

[DS25] K. Dworatzyk, T. Schlauch. Sharing is caring: the effect of knowledge exchange workshops on community commitment among research software engineers. In Kurosu and Hashizume (eds.), *Human-Computer Interaction*. Pp. 157–174. Springer Nature Switzerland, Cham, 2025. doi:10.1007/978-3-031-93835-1_10

[E-C] E-CAM. E-CAM training portal. Note: resources in the Spaces category can be accessed at the following address: https://lhumos.org/spaces. https://clowder.eessi.science

[FHH+20] B. Flemisch, S. Hermann, C. Holm, M. Mehl, G. Reina, B. Uekermann, D. Boehringer, T. Ertl, J.-N. Grad, D. Iglezakis, A. Jaust, T. Koch, A. Seeland, R. Weeber, F. Weik, K. Weishaupt. Umgang mit Forschungssoftware an der Universität Stuttgart. Position paper, University of Stuttgart, 2020. doi:10.18419/opus-11178

[FRM22] C. J. Fernandez, R. Ramesh, A. S. R. Manivannan. Synchronous learning and asynchronous learning during COVID-19 pandemic: a case study in India. *Asian Association of Open Universities Journal* 17(1):1–14, Feb. 2022. doi:10.1108/AAOUJ-02-2021-0027

[GFN+10] N. N. Gichora, S. A. Fatumo, M. V. Ngara, N. Chelbat, K. Ramdayal, K. B. Opap, G. H. Siwo, M. O. Adebiyi, A. El Gonnouni, D. Zofou, A. A. M. Maurady, E. F. Adebiyi, E. P. de Villiers, D. K. Masiga, J. W. Bizzaro, P. Suravajhala, S. C. Ommeh, W. Hide. Ten simple rules for organizing a virtual conference—anywhere. *PLOS Computational Biology* 6(2):1–4, Feb. 2010. doi:10.1371/journal.pcbi.1000650

[JSM+22] R. Joo, A. Sánchez-Tapia, S. Mortara, Y. Bellini Saibene, H. Turner, D. Hug Peter, N. S. Morandeira, M. Bannert, B. Almazrouq, E. Hare, L. Ación, J. P. Narváez-Gómez, M. Alfaro Córdoba, F. Marini, R. Giordano, S. Canelón, A. Ebou, A. R. Upadhya, J. Chávez, J. Ravi. Ten simple rules to host an inclusive conference. *PLOS Computational Biology* 18(7):1–13, July 2022.
doi:10.1371/journal.pcbi.1010164

[KMMK24] M. Katerbow, F. Mannseicher, S. Metzler, S. Karcher. Handling of research software in the DFG's funding activities. Handout, Deutsche Forschungsgemeinschaft, Bonn, Germany, Oct. 2024.
doi:10.5281/zenodo.13919790

[KRP+16] T. Kluyver, B. Ragan-Kelley, F. Pérez, B. E. Granger, M. Bussonnier, J. Frederic, K. Kelley, J. B. Hamrick, J. Grout, S. Corlay, P. Ivanov, D. Avila, S. Abdalla, C. Willing, Jupyter Development Team. Jupyter Notebooks—a publishing format for reproducible computational workflows. In Loizides and Schmidt (eds.), *Positioning and power in academic publishing: players, agents and agendas*. Pp. 87–90. IOS Press, 2016.
doi:10.3233/978-1-61499-649-1-87

[LMB+22] A.-L. Lamprecht, C. Martinez-Ortiz, M. Barker, S. L. Bartholomew, J. Barton, N. Chue Hong, J. Cohen, S. Druskat, J. Forest, J.-N. Grad, D. S. Katz, R. Richardson, R. Rosca, D. Schulte, A. Struck, M. Weinzierl. What do we (not) know about Research Software Engineering? *Journal of Open Research Software* 10(1), Dec. 2022.
doi:10.5334/jors.384

[MGH+20] C. Misa, D. Guse, O. Hohlfeld, R. Durairajan, A. Sperotto, A. Dainotti, R. Rejaie. Lessons learned organizing the PAM 2020 virtual conference. *ACM SIGCOMM Computer Communication Review* 50(3):46–54, July 2020.
doi:10.1145/3411740.3411747

[MLD+21] M. F. Meyer, R. Ladwig, H. A. Dugan, A. Anderson, A. R. Bah, B. Boehrer, L. Borre, R. J. Chapina, C. Doyle, E. J. Favot, G. Flaim, P. Forsberg, P. C. Hanson, B. W. Ibelings, P. Isles, F.-P. Lin, D. Lofton, T. N. Moore, S. Peel, J. A. Peters, D. Pierson, L. N. de Senerpont Domis, J. A. Schloss, M. Shikhani, A. P. Smagula, J. D. Stockwell, P. Thomas, R. Q. Thomas, T. Tietjen, K. C. Weathers. Virtual growing pains: initial lessons learned from organizing virtual workshops, summits, conferences, and networking events during a global pandemic. *Limnology and Oceanography Bulletin* 30(1):1–11, 2021.
doi:10.1002/lob.10431

[Nar09] T. Narten. Considerations for having a successful birds-of-a-feather (BOF) session. RFC 5434, Internet Requests for Comments (IETF), Feb. 2009.
doi:10.17487/RFC5434

[Oru21] A. Oruc. Tools for organizing an effective virtual academic conference. *Serials Review* 47(3-4):231–242, 2021.
doi:10.1080/00987913.2022.2050615

[PBF+18] Project Jupyter, M. Bussonnier, J. Forde, J. Freeman, B. Granger, T. Head, C. Holdgraf, K. Kelley, G. Nalvarte, A. Osheroff, M. Pacer, Y. Panda, F. Perez, B. Ragan-Kelley, C. Willing. Binder 2.0 - reproducible, interactive, sharable environments for science at scale. In Akici et al. (eds.), *Proceedings of the 17th Python in science conference*. Pp. 113–120. 2018.
doi:10.25080/Majora-4af1f417-011

[PK21] M. Pedaste, M. Kasemets. Challenges in organizing online conferences: lessons of the COVID 19 era. *Educational Technology & Society* 24(1):92–104, 2021.
https://www.jstor.org/stable/26977859

[Pot83] J. H. Potvin. Planning and organizing an annual conference. *IEEE Transactions on Professional Communication* PC-26(3):123–152, 1983.
doi:10.1109/TPC.1983.6448156

[SHMS19] T. Schlauch, C. Haupt, M. Meinel, A. Schreiber. Analytics and insights about cultivating a software engineering community at DLR. In *2019 IEEE aerospace conference*. 2019.
doi:10.1109/AERO.2019.8741902

[SKHK22] H. Schiele, S. Krummaker, P. Hoffmann, R. Kowalski. The "research world café" as method of scientific enquiry: Combining rigor with relevance and speed. *Journal of Business Research* 140:280–296, 2022.
doi:10.1016/j.jbusres.2021.10.075

[Smi20] D. R. Smith. Academic street smarts: be vigilant of fraudsters. *EMBO reports* 21(5):e50365, 2020.
doi:10.15252/embr.202050365

[WDA+16] M. D. Wilkinson, M. Dumontier, I. J. Aalbersberg, G. Appleton, M. Axton, A. Baak, N. Blomberg, J.-W. Boiten, L. B. da Silva Santos, P. E. Bourne, J. Bouwman, A. J. Brookes, T. Clark, M. Crosas, I. Dillo, O. Dumon, S. Edmunds, C. T. Evelo, R. Finkers, A. Gonzalez-Beltran, A. J. G. Gray, P. Groth, C. Goble, J. S. Grethe, J. Heringa, P. A. C. 't Hoen, R. Hooft, T. Kuhn, R. Kok, J. Kok, S. J. Lusher, M. E. Martone, A. Mons, A. L. Packer, B. Persson, P. Rocca-Serra, M. Roos, R. van Schaik, S.-A. Sansone, E. Schultes, T. Sengstag, T. Slater, G. Strawn, M. A. Swertz, M. Thompson, J. van der Lei, E. van Mulligen, J. Velterop, A. Waagmeester, P. Wittenburg, K. Wolstencroft, J. Zhao, B. Mons. The FAIR Guiding Principles for scientific data management and stewardship. *Scientific Data* 3(1):160018, Mar. 2016.
doi:10.1038/sdata.2016.18