Tips and Tricks for Organizing a Summer School—A Case Study Based on the "Nexus of Organic Matter Analytical Developments" School

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Tips and Tricks for Organizing a Summer School—A Case Study Based on the "Nexus of Organic Matter Analytical Developments" School

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Abstract

In June 2025 we organized and ran the first "Nexus of Organic Matter Analytical Developments" (NOMAD) Summer School at the Tjärnö Marine Laboratory in Sweden. In this article, we describe its development and implementation, with the aim of offering practical insights into the planning process, a generalizable framework for future summer schools, and key recommendations for organizers. We describe how we conceptualized the summer school and justify why it was needed, and recount our processes to acquire funding, recruit teachers, advertise the program, and select students. Additionally, we discuss how we designed the educational and social program to strike a balance between formal and informal educational and social content. Finally, we include comments directly from students to provide useful context and counterpoints from participants at such events.

Introduction

Summer schools provide a valuable environment for students and early-career researchers to develop specialized skills within a focused, intensive framework. They are particularly well suited to supporting learning in complex, interdisciplinary, and rapidly evolving fields, as they provide an opportunity for specialist researchers to present cutting-edge research and future directions without needing to revisit foundational concepts, or extensively cover the minutiae of adjacent methodologies. In addition to technical instruction, such programs foster networking, collaboration, and community-building across institutions and disciplines. As a result, they have become an increasingly important component of professional development in many scientific fields.

To that end, we organized the "Nexus of Organic Matter Analytical Developments" (NOMAD) Summer School, which aimed to synthesize frontier research developments in the study of organic matter. We describe how the school was planned and implemented, focusing on conceptualization and justification, acquisition of funding, recruitment of teachers and students, and the design of the educational and social program. For each section, we highlight what we feel worked well and what could have been improved. Student perspectives are included to contextualize what participants liked and disliked regarding the structure of NOMAD. These are written directly by student participants, based on their own impressions and informal discussions in larger groups, which also included students not listed as authors on the paper. Perspectives on advertisement and student recruitment are the exception, and are derived from a post-school survey. Overall, the event yielded a number of broadly applicable insights that will benefit future organizers of similar educational experiences.

The conceptualization and justification of the summer school

NOMAD focused on the analysis of aquatic organic matter, which is a blanket term for all organic carbon present in Earth's aquatic systems. This aquatic organic matter plays many important roles in diverse environments ranging from soil porewaters in terrestrial systems through to the deepest oceans and their underlying sediments. These roles include facilitating the cycling of a range of biogeochemically important elements, the mobilization of pollutants in aquatic networks, and serving as an energy source for heterotrophic organisms. The diversity of environmental behaviors of aquatic organic matter warrants its study across a range of disciplines, including ecology, geochemistry, oceanography and limnology, and agriculture and forestry.

Due to this inherent interdisciplinarity, the application of cutting-edge analytical techniques and the development of new theoretical frameworks often occurs within siloed research communities, before slowly spreading to different disciplines. Furthermore, the practical use of these analytical techniques, and the correct processing and interpretation of the data they provide, requires training over several years within hyperspecialized research groups. As a result, students working with aquatic organic matter are expected to keep up with contemporary research that uses techniques that they have no extensive training in, and theories developed from data they have little experience in handling. Moreover, due to the extreme complexity of aquatic organic matter, modern research often employs multiple analytical techniques to more thoroughly validate its conclusions. These challenges will only become more pronounced as advanced instrumentation becomes more widely available, the number of relevant publications students must understand each year increases, and interdisciplinary collaborations become more common.

It is therefore vital that students have a sufficient understanding of the practical use of the most effective and widely-used techniques in the field, the tools available to interpret their outputs, and the conclusions that can be drawn from their data. NOMAD aimed to meet this need by providing access for up to 40 students to an intensive week of study and discussion, curated by experts working at the forefront of analytical technique development and implementation. Four techniques were chosen for inclusion in the program; excitation/emission spectroscopy (EEM), mass spectrometry (MS), nuclear magnetic resonance spectroscopy (NMR), and isotope and tracer analysis. Each technique had its own dedicated day during the summer school and was hosted by at least two experts, with the final day focused on how multiple techniques can be combined to gain insight into fundamental questions around organic matter composition and its behavior in the environment. A focus was placed on the development of interactive seminars and workshops, building a comfortable environment to encourage students to ask questions, and the recruitment of approachable teachers who were open to in-depth informal discussions outside of planned teaching hours.

Student perspectives on the conceptualization and justification of the summer school

Organic matter research is a highly specialized field which is exciting and intellectually stimulating, but it can also be isolating for students without a strong local team doing similar work. Participating in a specialized summer school helped us counteract this isolation and provided opportunities for interdisciplinary exchange and collaboration, while also increasing our confidence as professionals.

From our perspective, one key benefit from the summer school was cross-disciplinary learning: dedicating each day to a different technique allowed most of us to encounter at least one technique we had not used before. Discussions on the strengths and limitations of each approach and the power of combining techniques were particularly useful, especially in considering how our own research could be expanded through collaboration. The summer school also facilitated the creation of support networks for us, both through formal and informal channels.

A critical outcome of attending this school was that we felt we could now approach the literature and our own data with more confidence. This confidence grew thanks to professional insights shared during the course, including practical "tips and tricks" from those with more experience in the field. With such advice, many potential errors (e.g., improper sample storage or failure to collect critical metadata) can be easily avoided. Overall, the school made us feel more connected, inspired, and eager to apply what we learned to our own research.

Cost and funding of the school

Before pursuing funding, we established that there was sufficient demand for the course. We surveyed about 30 research labs, nearly all of which indicated that they would be interested in either helping to teach or sending Ph.D. students to attend. Two funding sources were identified: The Carl Tryggers Stiftelse (CTS) Foundation, which has an annual call specifically for summer schools in Sweden, and the European Geosciences Union (EGU). EGU's grant specifically targeted schools for early career researchers (<6 yr from Ph.D.), while CTS had no restrictions on the use of funds. We submitted similar proposals (available in the Supporting information), and were successful with both, receiving 113,886 SEK from CTS (~12,500 USD) and 6000 EUR (~7000 USD) from EGU. Funds were administered by the Department of Chemistry for Life Sciences at Uppsala University, with an overhead of 32.5% in 2025, meaning that the effective available funds for NOMAD totaled 14,700 USD.

The services and costs required to hold the school were conveniently managed by Tjärnö Marine Laboratory (Fig. 1), making planning relatively straightforward. The site provided accommodation, with double and triple rooms for students with shared bathrooms, and single en-suite rooms for teachers, as well as three meals per day and two coffee breaks. It also charged an on-site "bench fee" to provide access to lecture halls, simple laboratories, and equipment and infrastructure for social activities, which included rowing boats and snorkeling equipment. The site fee totaled 5980 SEK (650 USD) per student (shared accommodation) and 7030 SEK (750 USD) per teacher (single accommodation). Value added tax was not charged for Swedish university payments, exempting costs for teachers and scholarships. It would have been far more expensive to host the school at a more easily accessible location (e.g., a city like Uppsala), and it would also have had less of a focused and private feeling.

We decided that any funding received would first be used to pay for teachers' travel and combined site fees (accommodation, food, and "bench fee") with remaining funds being allocated for student scholarships, which would cover site fees but not travel. Students without their own full funding could ask to be considered for a scholarship when applying to NOMAD. Those who wanted to be considered had to describe their motivation for attending the school in a short essay, which was evaluated and ranked on merit by a panel of five organizers. The largest single cost was for travel for teachers based outside Europe (~1500 USD per

FIG. 1. The Tjärnö Marine Laboratory from the sea. (Photo credit: Martin Larsvik).

person), so we capped staffing to a maximum of two teachers from outside the continent, and aimed to have as many local (i.e., Scandinavia-based) teachers as possible, both to save funds and reduce environmental impact (see section *Staffing the school*). In the end we paid for travel and site fees for 9 of 10 teachers, and funded seven student scholarships (of 33 students).

Student perspectives on cost and funding

We felt the scholarships were important in enabling students to attend NOMAD. These funds helped to lower the cost barrier for those attending and expanded the international reach of the school. Many of us were only able to attend due to the scholarships, with one student emphasizing: "*I think it's important that more future summer schools make funding available to promote diversity in the field*." This sentiment is further reinforced by the fact that even with several NOMAD scholarships available, all of us needed to secure funding from other sources to be able to attend. The total daily cost of ∼130 USD for all accommodation, food, and infrastructure was widely considered by us to be both affordable and good value.

The location was consistently highlighted as an aspect students enjoyed: "*The Tjärnö Marine Laboratory was a beautiful location for the school, with plenty to do. Despite my initial apprehension about going somewhere so remote, there was an intimate feeling*." Evening time activities we enjoyed included snorkeling, walking, and going to the sauna. Staff and students mingled at mealtimes, which for many of us made staff feel more approachable. Overall, we felt the location and amenities provided excellent value for the cost of attending. In particular, catered meals allowed us to dedicate more time to learning and networking and left the organizers free to interact with students rather than focus on food shopping and meal preparation.

Staffing the school

Selecting teachers for NOMAD required consideration of several aspects: balance of the group (e.g., combining experienced and early career teachers, gender balance), cost and environmental impact of their travel, and synchronicity with the intended program (i.e., consideration of whether teachers were highly specialized or cross-disciplinary and of how they might work together in giving students an impression of distinct vs. combinable research areas). Obviously, it was also necessary that teachers were available for the planned dates, and several candidates who were unavailable expressed interest in contributing to future iterations of NOMAD.

Staffing was handled by the organizers in a meeting one year ahead of hosting the school. A set of five topics were suggested by the head organizer, with two teachers proposed for each. Four topics were selected during the meeting, and the proposed teachers contacted, who mostly showed immediate interest and agreed to participate. There is fortunately a fairly healthy gender and career stage balance in our field, so it was not challenging to find outstanding candidates who met several of the other criteria we aimed for. Additional considerations included the ability to teach multiple topics, belonging to dynamic research groups that could take on new collaborations, and keeping diversity high in terms of career stage, gender, and country of institution. The final constellation of teachers is shown in Table 1. We strongly recommend choosing a team based on their ability to provide contrasting opinions about the state of the field and its future directions, rather than solely based on their research history. The ability to form new collaborations both between the teaching staff and with the school's students should be considered, as participants will likely become the next generation of postdocs and researchers.

Student perspectives on staffing the school

Recognizable names from the literature strongly motivated us to apply and provided initial reassurance that the school would be a worthwhile learning opportunity. However, for many of us, the range of attending scholars and institutions they represented was just as attractive. During informal discussions, one participant emphasized that seeing instructors from multiple institutions "*added credibility to what we would learn*," as it signaled that we would gain not only individual perspectives but also broader insights from across the field. A program featuring a narrower set of subdisciplines or with researchers from a single university would have been less appealing. Moreover, the diversity of instructors ensured a wide breadth of topics were covered, which helped us to see our own research interests represented and feel that our work has a place in the field.

TABLE 1. Information on teachers at the NOMAD summer school. HRMS = high resolution mass spectrometry, NMR = nuclear magnetic spectroscopy

Name	Institution, country	Gender identity	Career stage	Techniques
Alexander Craig	Uppsala University, Sweden	Male	Early career	HRMS, NMR
Margot White	Eidgenössische Technische Hochschule (ETH) Zurich, Switzerland	Female	Early career	Isotopes and tracers
Nicholle Bell	University of Edinburgh, United Kingdom	Female	Early career	NMR, HRMS
Urban Wünsch	Chalmers University of Technology, Sweden	Male	Early career	Spectroscopy
Brett Walker	University of California, Irvine, United States of America	Male	Mid-career	Isotopes and tracers
Jeffrey Hawkes	Uppsala University, Sweden	Male	Mid-career	HRMS
Juliana D'Andrilli	University of North Texas, United States of America	Female	Mid-career	HRMS, spectroscopy
Fernando Rosario-Ortiz	University of Colorado, United States of America	Male	Established	Spectroscopy
Kathleen Murphy	Chalmers University of Technology, Sweden	Female	Established	Spectroscopy
Norbert Hertkorn	Linköping University, Sweden	Male	Established	HRMS, NMR

Gender balance among faculty was another highlight of NOMAD. Several of us noted that women comprising nearly half of the instructors positively influenced our decision to apply. Others said they would have applied regardless of gender representation, but that they "*felt more comfortable networking and speaking up in class because of the balance*." Variation in teaching styles, pacing, and expectations also shaped students' experience, with many noting that it enhanced their learning. One student summarized their experience as follows: "*I enjoyed the different pace of teaching and mixture of teaching styles at the school. All of the days included some practical component, which helped to keep me engaged*." Others reiterated that while a predictable format can feel comfortable, variation across instructors helped maintain engagement during an intensive, week-long program.

The mix of early-, mid-, and established-career scientists allowed us to gain different perspectives on how to build our own careers. Discussions extending beyond formal course content introduced students to a global panel of potential collaborators and a landscape of employment opportunities. Some of us discussed funding structures, academic cultures, and career pathways (particularly differences between research environments in Europe and the United States) and valued being able to seek advice on building professional networks, applying for funding, and becoming a principal investigator. Overall, we felt that one of the most valued aspects of the summer school was the composition of the instructional team. It fostered an inclusive atmosphere, enriched networking opportunities, and reinforced the importance of interdisciplinary and international perspectives in academia.

School advertisement and student recruitment

Effective advertising is a challenge with an increasing number of social media platforms and potential communication methods. The advertisement strategy consisted of multiple channels including emails, announcements at workshops and conferences, social media posts, in-person communications, and "latest" or "recent" news posts on individual research websites. NOMAD information was provided with a single contact person to encourage students to reach out for questions. The organizing team identified target dates for continual announcements and posts to distribute the pertinent information, including reminders before the application deadline. We kept the application deadline date in the email subject line and within the body of the email so that recipients would always have that information easily accessible.

The school attracted a diverse set of applicants. In the time between the first advertisement (early December 2024) and application deadline (late January 2025), we received 62 applications. Of these, 43% were submitted in December, shortly after opening for applications, with the remainder submitted in the three weeks leading up to the deadline. Based on public profiles and first names, we estimate that ~55% of the applicants were female and ~40% male. The majority of applicants were affiliated with African, North American, and European institutions (29% each), followed by South American (8%) and Asian institutions (5%). Applicants were predominantly Ph.D. students (56%), followed by MSc. students (24%), postdocs/early career researchers (15%), and established researchers (5%).

We selected five people from the organizer and teacher pools to rank all 62 applications based on career stage and laboratory techniques to assess whether this school could help train the applicants. This process was used to decide which of the 62 applicants could be offered a spot in the summer school. For the 46 applicants that also requested one of the seven available scholarships to attend the summer school, a more detailed assessment was conducted. The overall quality of the motivation letter was graded to assess whether the applicant was suitable for participation in the school based on their background and research interest. Each member scored the scholarship applicants independently on a scale from 0 to 10 (10 being assigned to the top applicant) and the scores were summed to form the final ranking. In the end, 33 "students" attended the school (several of which were early career researchers, rather than strictly students), in a 21 : 11 female: male split (according to name only), and split between Europe, North America, South America, and Asia 17 : 12 : 1 : 2.

Student perspectives on advertisement and student recruitment

A survey conducted among the 36 NOMAD participants (students plus non-teaching staff) in February 2026 helped to identify successful and desirable strategies for advertising the summer school. From the 25 respondents, 69% heard about NOMAD via their own academic network ("word of mouth"), 24% via email lists, and one each learned about NOMAD during a conference and through the social network Bluesky. When asked about the relative importance, participants ranked outreach methods in the following order: (1) email, (2) co-workers/friends, (3) conference talk announcements, (4) LinkedIn, (5) ResearchGate, (6) Bluesky, and (7) X (formerly Twitter). Participants were also asked for additional ideas, with suggestions including a centralized summer school website, contacting scientific organizations or networks (e.g., ASLO) to help spread information, disseminating via email lists (e.g., GLEON or EcoLog), and directly emailing collaborators and instrument facilities.

Designing the educational program

Our first decision in designing the educational program was that each of the four main analytical techniques would be featured individually for a full day. This began with EEM on Monday, followed by MS on Tuesday, NMR on Wednesday, and isotopes and tracers on Thursday. We envisioned that the final day (Friday) would be used to synthesize information from the previous days into a more theory-oriented content titled "structure and reactivity." The division of techniques to specific days was chosen to keep students more focused, and we intentionally chose the topic with which we predicted students would be most familiar for the first day, to allow students to ease into the learning environment. This general structure felt successful, and we would recommend this type of partitioning of information for future schools, where possible. One limitation was that it restricted coordination between different teacher groups and thus connectivity between each day of the course, but we believe this could be adjusted during the planning stages in future schools.

Approximately one month before the summer school began, we prepared a survey to identify the average experience of incoming students with different techniques and theories. This allowed us to tailor content to the level we expected would provide the best learning outcomes. Each teaching group contributed questions for this survey related to their individual expertise, which generally worked well. This survey, for example, confirmed our expectation that EEM would be the most widely understood, and highlighted that NMR was the least understood among participants. As a result, the EEM day focused only briefly on theory and instrumentation and more on advanced data interpretation, while the NMR day focused on basic theory and general outcomes from data collection and interpretation. Simultaneously, teaching staff began preparing their teaching schedules in stages. First, general daily structures were proposed, identifying the number of lectures and workshops, and what content would be addressed in each session. This initial schedule was modified in response to student surveys, before teaching materials for individual sessions were prepared by the teachers in each group. One outcome of this planning was the selection of read-ahead material (one or two papers for each technique) for students.

Each day was designed to balance lectures with discussion and active learning. One advantage of a summer school format is that participants quickly become familiar with each other, increasing the overall comfort level and promoting a friendly environment for discussion. Students had the opportunity to ask questions specific to their own work, with many follow-up conversations happening not only during formal teaching times, but also during meals and coffee breaks. However, this abundant conversation during lectures meant that flexibility within the schedule was important, as it was challenging to predict how long the formal teaching tasks would ultimately take. The summer school format was important here as well, as teachers could work together to modify content until very close to the beginning of individual lessons. We prioritized tasks where students worked with real data, as a way to solidify their learning of concepts and tools, as well as formats that enabled them to practice "soft skills," including working in groups and presenting.

Within the teaching group, key takeaways based on organizational structure, leadership, and delegation were evident. First, iterative preparation of the course in stages of increasing depth was seen as highly beneficial. These stages were marked with virtual planning meetings, that allowed different teachers to share their ideas, and ensured that all teaching groups kept to schedule. The student survey was essential in educational content design, and we would highly recommend future summer schools implement a similar questionnaire, ideally several weeks prior to the beginning of the course. Notably, we made the decision that each day would have at least two teaching staff, as it ensured content was kept general and approachable to students across a range of disciplines. However, this presented challenges when teachers had different visions regarding the structuring of days and content. We recommend that a cohesive vision is developed early on, and clearly communicated to teaching staff, and that strong central leadership is implemented to make final decisions about disagreements and misunderstandings.

Student perspectives on the educational program

As highlighted by the pre-course survey, we arrived with different levels of experience and exposure to different topics. We felt the pre-course survey worked in both directions; staff could tailor lessons to fit students' knowledge, and students got a sense of what baseline knowledge they should have to engage with each day's topics. Many of us used this survey to prepare ahead of the course. Pre-reading assignments sent out by teachers also aided in our preparation. Focusing each day on a different analytical technique ensured that all of us gained exposure to techniques we were less familiar with, while also getting a chance to delve deeper into techniques we already use. As was mentioned before, taking up a fresh topic every day made it easier to stay engaged over the course of the week. We felt that the mix of lectures with hands-on activities and group work prevented burnout and further supported learning by promoting collaboration between students with different expertise.

As noted earlier, we felt that the greatest takeaway from the course was enhanced confidence in critical thinking and interpretation of our own data. Some students mentioned updating their research plans to incorporate additional samples or measurements based on the course material. The course also expanded our collaboration networks and resources. Many of us now know experts in techniques we are less experienced with, whom we can turn to in the future. Finally, we feel the course expanded our horizons in thinking about organic matter, a highly diverse and complex mixture. This was aided by the final day focused on synthesis and future directions, with one of us noting: "*Not even the instructors were totally aligned in their thinking; exposure to this diversity was helpful*."

On a practical note, access to lecture materials and example datasets has remained valuable well beyond the duration of the course. Many of us continue to reference these materials, which the organizers shared with us via email. Future courses could further aid student learning by consolidating course materials in a centralized, accessible repository like Google Drive or similar.

Designing the social program and balancing educational and social components

The social aspect of the school was designed to prevent participant burnout from long days of formal teaching, to cultivate student–teacher cohesion, and to foster post-school scientific collaboration. Rather than treating social interaction as an afterthought, we designed a social program that leveraged the surreal beauty of the unique coastal setting of Tjärnö Marine Laboratory (Fig. 2). The typical daily social agenda included informal conversation and networking opportunities for approximately an hour at each meal time, a half-hour mid-morning and afternoon coffee break, and longer times for socialization in the evenings. We also scheduled a free afternoon on the third day for leisure activities in which participants could explore Koster fjord (Kosterfjorden) through hiking, snorkeling, rowboats, and swimming.

The social program at NOMAD consisted of passive and active components. We used several indoor and outdoor social hubs at the on-site accommodation that allowed for low stakes conversations between students and teachers. We also had several scheduled engagements, such as ice-breakers, games, and unscheduled informal time during which participants could use the on-site sauna, snorkel, tour the in-house aquarium, and take spontaneous seaside walks and hikes. These opportunities provided inclusive alternatives to traditional alcohol-centric evening socializing, and maximized time spent in nature, which helped reduce participant stress and assisted in recovery after intense workdays.

FIG. 2. The Tjärnö Marine Laboratory site in summer. (Photo credit: Anna-Lena Lundqvist).

Based on our experiences, we recommend several considerations and potential improvements for intensive summer schools. First, we suggest that connection between participants is initiated before the summer school, by circulating a digital participant and instructor directory with photos, research focus, and contact information. Additionally, participant name tags should be included that specify individual research focus, to assist in scientific networking during the welcome evening and early social events. Next, we recommend designing a social calendar that prioritizes inclusive, activity-based engagement (i.e., ice-breakers and games) over traditional bar-based mixers to avoid social exclusion and maximize the feeling of belonging for a diverse range of participants. Finally, we recommend that quiet spaces should be provided for those who require alone time to manage the high cognitive load of an intensive weeklong science program.

Student perspectives on the social program balance of educational and social components

We felt that the inclusive and social atmosphere was one of the highlights of the course. The course felt like a venue where we could establish future collaborations with professors and other students. From our perspective, the organizers' forethought and intentionality, as well as the location and amenities of the Tjärnö Marine Laboratory, supported this social structure. Dedicated unstructured time, including meals and free time, provided ample opportunities for students and instructors to mingle and prevented student burnout during the week. We also appreciated that many activities were intentionally alcohol-free and instead focused on enjoying nature or spending time outside: "*Walking trips around campus enabled chit-chat about science, research, and life outside work. I felt it created a nice atmosphere between students and between students and instructors*."

The isolated nature of the campus further supported social activities by encouraging us to self-organize as a cohort (Fig. 3). The location provided ample opportunities for outdoor recreation, and we organized group activities almost every day. The consistent availability of unstructured time also gave us the freedom to opt out of activities when

FIG. 3. The NOMAD teachers and students in front of R/V Nereus. (Photo credit: Gunilla Johansson).

needed to rest and refresh, without fear of missing out. Much of this self-organization took place during meals and coffee breaks, and in "micro" social spaces such as shared dormitory halls. A WhatsApp group also facilitated communication about both the course and social activities. Based on these experiences, we would encourage future courses to support informal interactions and establish a communication network that is inclusive and considerate of all participants.

Summary

Overall, our organization and subsequent implementation of the NOMAD summer school provides a practical framework for future educators seeking to design similar events, with our proposed timeline highlighted in Fig. 4. Early considerations should include identifying the needs of the school, securing funding, and recruiting teaching staff. We recommend identifying the needs for the school at least a year before any planned event, and believe that demand can be identified by reaching out to lab heads in the research field around this time. Funding opportunities should be investigated as early as possible (i.e., around a year before the planned event), targeted at multiple sources, and considerations should include how funds will support teacher recruitment, reduce costs transferred to participants, and pay for student scholarships. While teacher recruitment is critical for a successful educational environment, it is also impactful in drawing students to the school. We strongly recommend that diversity in staff is considered not only in terms of career stage, gender, and location of employment, but also in the context of perspective, expertise, and career history.

Once the initial framework of the school is complete, the announcement, advertisement, and opening of applications should occur at least six months prior to the actual event. We found the most effective means of student recruitment was through word of mouth and direct emails to lab heads, and that social media advertisement was largely secondary, although this could have been due to our chosen advertisement strategy. Student selection is important in informing the design of the educational program, and we believe tailoring a course to the average level of the students in different areas is vital in maximizing learning outcomes. We found a pre-course survey particularly valuable for this, as it allowed us to tweak the content level of our individual topics, without having to assume the knowledge level of students. Furthermore, balance between lectures, workshops, and social activities is critical to engagement, as overloading students in moments can slow down learning across entire days. Building in flexibility within educational content was the most useful way to mitigate the potential for students to be overwhelmed, as it allowed for teachers to either reduce or increase the length of lectures or workshops in response to the pace and energy of the student group. Finally, careful balance of social and educational activities are vital, as social activities can foster both ineffable aspects such as sense of community and shared experience, and also allow for networking and the development of collaborations between staff and students. More broadly, our experience highlights that intentional design across educational, logistical, and social dimensions is critical for developing summer schools that not only communicate knowledge effectively, but also support the formation of research networks and future collaborations.

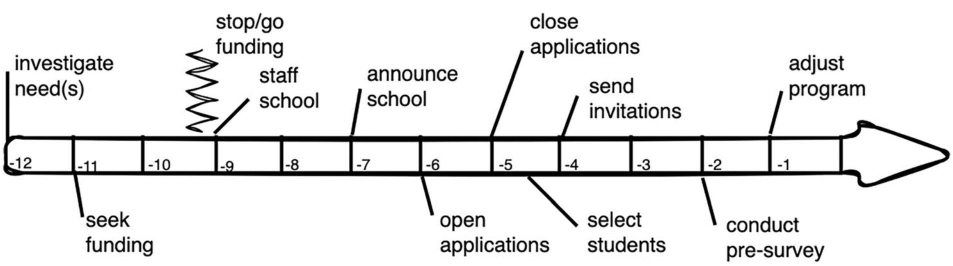

FIG. 4. Timeline for summer school planning based on NOMAD organization and implementation, numbers indicate months before the start of the school, and the point for deciding whether to go ahead with the school is indicated based on funding success, ~10 months from the planned date.

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Supporting information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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