

Interactivity, engagement and community building in online HPC education and training

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Abstract—A significant portion of High Performance Computing (HPC) Education and Training is centered on short courses, workshops, and hackathons. While there is a substantial amount of content and documentation online, there are relatively few open access virtual courses[1]. As a result of the shutdowns associated with COVID19, many HPC educators are scrambling to transition their events online. This paper highlights the key characteristics of Virtual Learning Environments (VLE), presenting challenges when it comes to interactivity, networking, and community building, as well as focusing on primary advantages such having events with no borders. Finally, we present effective strategies for transitioning to VLEs to maximize the experience.

Index Terms—HPC Education, Virtual Learning Environments, Online Training,

I. INTRODUCTION

High Performance Computing (HPC) practitioners have traditionally come from Science, Technology, Engineering and Math (STEM) disciplines. With the advent of data science programs, HPC resources have become integral parts of many other disciplines, such as social sciences, film, and humanities. Bringing members of these domains into a Community of Practice creates unique challenges not seen in other disciplines. That challenge is magnified with the inconsistent approach to “learning” HPC - traditionally from academic courses but more commonly in brief workshops and training. In both instances, the explicit goal is to develop a workforce with HPC specific skills. As important is the implicit goal of building a Community of Practice around HPC applications, education and knowledge, that supports new members and enables the cross-pollination of insights across disciplines.

Until recently, the majority of training events were delivered in face-to-face settings with a relatively small instructor to learner ratio, which ensured better engagement with the educational content, allowed for interactivity between the participants, and contributed to the overall community building. The forced transition from in-person to online education, caused by COVID-19, resulted in numerous quick conversions of in-person workshops. However, many strategies used for in-person teaching are ineffective when simply transferred to a virtual setting. To ensure that virtual HPC education and training fulfills its role, special attention needs to be paid to interactivity, engagement and community building aspects of

the online training events. In this paper, the authors briefly describe some key characteristics of virtual learning environments (VLEs) and share their insights on effective strategies for transitioning to VLEs.

II. KEY CHARACTERISTICS OF VIRTUAL LEARNING ENVIRONMENTS

A. Challenges

Despite technological advances, humans are still predisposed to in-person interactions, and find virtual interactions more stressful and less natural, due to the lack of non-verbal cues, immediacy and intimate shared surroundings. For these reasons, many standard interactivity and community building aspects of in-person sessions do not easily translate to the virtual domain, in particular:

- informal activities, i.e. virtual coffee or meal breaks, so effective in in-person settings, are often perceived by participants as awkward or even forced,
- social learning activities intended to create comfort zones - allowing people to get used to talking and working with strangers - require more effort and careful consideration in the virtual environment, e.g.;
 - Think-Pair-Share or Jigsaw[2] are more logistically complicated in VLEs and
 - serious games often lose the social learning aspect when converted to virtual games.

In addition to the interactivity aspects that are challenging in the virtual environment, it is significantly harder and more complex to track learner or project team progress and contributions, rendering it challenging to intervene meaningfully in a timely manner. This is compounded when attendees with low bandwidth are unable to use the learning platform’s video capability, thus removing the instructor’s ability to see the learner and gauge their understanding. “Faceless participation” also creates a barrier to peer-to-peer social interactions and community development. Finally, for many people with learning, visual or hearing disabilities, VLEs place additional obstacles to learning.

B. Advantages

Many instructor teams transitioning a well-oiled workshop into the virtual environment are understandably focused on

the challenges, but virtual environments are not lesser, they are different, complete with their own benefits. Among the primary benefits, virtual events remove the need for travel and the associated reduction in attendee cost results in events that tend to be more inclusive and diverse, with a broader demographic (age, field of study/domain) and geographic range of participants. In addition to increased accessibility, the lack of travel costs means that specialists can be available “on call”, just a click away. Mentors for hackathons, for example, whose deep expertise make them highly sought and fully booked, may be able to squeeze in daily short consults, rather than a week of out-of-the-office[3]. Finally, because virtual workshops are not tied to a specific block of in-person time, it is possible to more purposefully structure the workshop timeframe to reflect best practices in teaching; e.g., enabling a sequence of presentation/demonstration, followed by individual experimentation and reflection, followed by synchronous meetings and project activities.

III. DESIGN RECOMMENDATIONS FOR VIRTUAL LEARNING ENVIRONMENTS

Design of a virtual training event requires not only content preparation ahead of time but also careful attention to the methods and activities that will prompt learners to engage with the content, fellow learners and projects. The virtual environment has greater negative impact on a learner’s attention than in-person training events and requires breaking content delivery into smaller chunks with more frequent breaks. Traditionally both in-person and virtual environments have introduced breaks in content delivery via polling and “Question and Answer” prompts to keep learners engaged and get a sense of how well the content, pacing and delivery are being received. In VLEs other successful activities aimed at specifically engaging social interaction and community building include:

- ice breaker activities such as asking attendees to drop a pin on a virtual map to indicate where they are joining from,
- providing welcome sessions to enable small groups to introduce themselves in a break out room or around a virtual table, in order to meet fellow learners and become accustomed to the delivery media, and
- creating channels as “ # introduce_yourself” on Slack so participants can introduce themselves to fellow participants in a couple of sentences, and mention their expertise and interests similar to a standup introduction in a *live* event.

As with in-person workshops, challenge problems that integrate the concepts and necessary skills provide a means for social learning and community building. Activities such as hackathons that focus on using the concepts in a real-world, team-based, authentic scenario lead to increased understanding and retention because of the guided practice integrated into the learning activity. Building group activities in a virtual environment is tricky, but there are several techniques that support interactive projects,

- encouraging all participants to keep their microphone open to
 - eliminate hurdles to speaking when something in the larger conversation motivates engagement, and
 - be available when project team members have a quick question,
- integrating collaborative tools for project management and development
 - Google Docs provides an easy way to capture project design, team roles and tasks
 - Git for sharing software development
 - chat tools, e.g. Slack, Mattermost and Discord, for short discussions, conversations and questions

Finally, to maximize the potential for a smooth, accessible event and minimize the potentially disruptive technical glitches, we recommend the following:

- review and implement the strategies to support accessible online learning[4],
- a dedicated technical support person to assist learners, particularly in the first meeting,
- designate one or more instructor(s) to watch the communication channels to collect and forward questions,
- designate instructors or specialists who visit multiple breakout rooms to guide teams and insure that no one is stuck,
- create a back-up plan. Technology can fail, which can leave you without a presenter, affect a breakout room or project, and
- establish a communication back-channel for organizers to coordinate or troubleshoot without distracting the learners.

IV. CONCLUSION

HPC education and training has been slowly moving into VLEs in order to scale, broaden participation to include attendees who are unable to travel, and extend the Community of Practice. The push toward VLEs brought on by the pandemic has highlighted the need for guidance and techniques to maximize the advantages and minimize the challenges. This paper has highlighted some of the design considerations required to integrate the benefits of VLEs into training events so that the event, while different than an in-person event, is as valuable.

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