

# The CyberAmbassador Training Program

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## ABSTRACT

The CyberAmbassador project aims to provide professional skills training for CyberInfrastructure (CI) professionals, with the goal of developing “CyberAmbassadors” [16] who are prepared to facilitate and lead multidisciplinary, computationally-intensive research. This NSF funded program (Award Number 1730137) has the following objectives: (1) Develop curriculum that focuses on professional skills (communications, teamwork, leadership) within the context of large scale, multidisciplinary computational research; (2) Pilot, evaluate and revise the curriculum; (3) Develop “Train the Trainers” workshops to broaden the impact of the curriculum and connect with external partners to ensure the longevity of the program beyond the timeframe of the grant. This paper introduces the core curriculum, describes different modes of delivering content that we have piloted, shares preliminary evaluation results from two particularly relevant cases, and offers initial lessons learned.

## CCS CONCEPTS

• **Social and professional topics** → **Professional topics; Computing profession; Computing occupations** • **Social and professional topics** → **Professional topics; Computing education; Adult education**

## KEYWORDS

Cyber-Infrastructure, Professional Training, Teamwork, Leadership and Communication

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## 1 Core Curriculum

Building on the idea that knowledge is constructed in a sociocultural context [14], the core of the CyberAmbassador curriculum is a series of individual and small-group activities (Figure 1), many of which incorporate role-playing scenarios. These types of role-playing exercises encourage active learning [10] and have been used successfully to teach professional skills in a variety of settings, ranging from healthcare [2,4,5,8] and business [1,9,11] to science and engineering [12]. The role-play scenarios are taken from the real-life experiences of CI Professionals who have worked on multidisciplinary research.



Figure 1 – A facilitator describes a small-group activity during a CyberAmbassadors training workshop

The CyberAmbassadors curriculum is broken up into modules, each about 2 hours in length, which are designed to be given individually or combined to meet the needs/interests of the audience. The entire curriculum can be easily taught in a 2-day workshop. Current core modules include:

- **First Contact:** An important type of conversation is the initial contact between two people (e.g., elevator talk, intake interview, social event, office hours); this “first contact” can be pivotal in establishing the foundation of a future

professional relationship. This module provides participants with tools to network more effectively by identifying common goals and interests and laying the groundwork for building a productive relationship in the future.

- **Complex Conversations:** This module focuses on communicating one-on-one with colleagues from different backgrounds about complex goals. The tools in this module focus on the “speaker” and “listener” roles and offer specific tools for improving understanding on both sides of the conversation. Activities use examples from science and engineering that are designed to demonstrate how significant complexity can inject problems in communication.
- **Communicating a Problem:** Communicating about interpersonal problems can often trigger strong emotions in both the speaker and listener. This module teaches participants techniques to communicate effectively about problems and engages them in practice activities designed to help them resolve the problem while maintaining the relationship.
- **Effective Meeting Management:** This module examines the logistics of meeting planning (deciding when a meeting is needed, how to organize the meeting effectively, how to keep the meeting on track, how to ensure follow through on decisions) and discusses how technology can be used to facilitate team communication and minimize wasted time.
- **Problem Solving and Decision Making in a Group:** While brainstorming can be a great way for a group to generate ideas, it is only half of the problem solving process. To use the results of brainstorming effectively, groups need to establish selection criteria, reduce the list, and identify the solution that best fits the goal. This module introduces tools for effectively facilitating brainstorming and decision making in a group, including techniques to ensure everyone is included in the process and supportive of the final decisions.
- **Roles, Responsibilities and Leadership Styles:** Highly successful teams share a number of common structures and processes, which are presented in this module. Participants learn how effective teams distribute work, leverage team members’ strengths, and compensate for weaknesses.
- **Ethics and Diversity:** While conversations about ethics and diversity are integrated throughout the CyberAmbassadors curriculum, this module provides an opportunity for more focused conversation about issues of ethics. Topics include diversity, power imbalance, research practices and inclusion.

## 2 Evaluation and Feedback

During the first 18 months of the CyberAmbassadors program, the curriculum was developed and pilot tested in a variety of formats, including:

- **In-Person Training:** We have piloted 1 and 2 day training workshops covering the entire curriculum (all modules) to graduate students and CI professionals.
- **For-Credit Class:** In the spring of 2019, a 2-credit course at for graduate students at Michigan State University included the entire CyberAmbassador program along with the “Entering Mentoring” [3] training program and materials related to the University’s Responsible Conduct of Research (RCR) requirements.

- **Online Training:** The Campus Research Computing Consortium (CaRCC) hosts a monthly meeting via zoom (videoconference) for Research Facilitators [17]. These monthly professional development sessions cover a wide range of topics in a one-hour, online format. Two of the CyberAmbassador modules (Effective Meeting Management and Complex Conversations) were presented in separate one-hour meetings for CaRCC, using a combination of lecture, large group discussion, and small group activities conducted in online “breakout” sessions also using zoom.
- **Hybrid Training:** In both 2018 and 2019, portions of the CyberAmbassador program were piloted at the ACI-REF Virtual Residency workshop [7] in Norman, OK. This provided an ideal “hybrid” teaching model where some participants worked in groups locally while others participated remotely using zoom.

During this pilot phase, we conducted 15 training sessions (of varying lengths and formats) with approximately 80 individuals receiving training in-person and approximately 200 individuals receiving training on-line. While the CyberAmbassadors program was designed specifically to address the needs of CI Professionals, as we developed and piloted these materials we had opportunities to test them with both students and professionals from many areas of science and engineering. This pilot testing process provided valuable information about ways to refine and improve the curriculum, and by including students we were able to train emerging CI professionals as well as more experienced research facilitators.

Since PEARC focuses on the needs of CI Professionals, this paper will focus on preliminary results from two training workshops that specifically served CI Professionals: one in-person training and one online training, both of which covered the “Mastering Complex Conversations” module.

### 2.1 Demographic Comparisons

Eight professionals participated in the in-person workshop and evaluation; 11 professionals did so for the online training. Both groups have similar gender balances: 50% of the in-person group identified as female, and 46% of the online group identified as female. 100% of respondents in both groups obtained their university degree in the USA, though there were international citizens in each group. The in-person workshop included more professionals who reported being early- or mid-career (4 months to 1 year in their role); participants in the online training group were generally more seasoned, and reported having been in their role for 3 years or longer.

### 2.1 Evaluation strategy

Using a Kirkpatrick model of evaluation [6], we focused on capturing participants’ reaction to the training and their learning gains. The reaction phase, which is the first level of the evaluation, was measured by the degree to which participants found the curriculum and the training event to be useful. In terms of the learning phase, we compared the participants’ knowledge and abilities before and after training. Participants were asked to

respond to a variety of questions using a five-point Likert scale, ranging from very low (1) to very high (5).

Analyzing the results from the reaction evaluation of the “Mastering Complex Conversations” (MCC) module, Table 1 shows that the participants were highly satisfied with the curriculum. They agreed that the topic was relevant to their daily work and appropriate for their experience level. Besides the curriculum, participants were also satisfied with the structure and the pace of the training. Overall, the program met the participants’ expectations and they were willing to recommend the training. Participants in the in-person training reported slightly higher satisfaction with the training than did the online participants.

**Table 1 – MCC Module Reaction Evaluation**

| Component of Reaction                               | Mastering Complex Conversation |                | Average |
|---|--------------------------------|----------------|---------|
|   | In-Person Meeting              | Online Meeting |         |
| <b>OVERALL CONTENT</b>                              |                                |                |         |
| Satisfaction with the curriculum                    | 4.88                           | 4.55           | 4.71    |
| Relevancy of the curriculum with work they do       | 4.88                           | 4.55           | 4.71    |
| Appropriate for their level of experience           | 4.50                           | 4.18           | 4.34    |
| <b>TRAINING IMPLEMENTATION</b>                      |                                |                |         |
| Satisfaction with the structure                     | 4.63                           | 4.36           | 4.49    |
| Satisfaction with the pace                          | 4.50                           | 4.45           | 4.47    |
| Degree to which the program meet their expectations | 4.75                           | 4.50           | 4.62    |
| Willingness to recommend the training               | 4.75                           | 4.70           | 4.72    |

The participants were asked about the elements that they liked most from the workshop. Both in-person and online participants reported valuing the role-play scenarios, as they found that the scenarios were interactive and realistic. In particular, qualitative data from the evaluation revealed that participants valued the training in how to avoid jargon or “negative” language. One participant reported: “What I find most helpful is the execution of what facilitators may brush off as assumed knowledge and/or theoretical into realistic, practical training scenarios that expose weak points in our communication efficacy.”

Table 2 captures evaluation data around the learning gains reported in response to the “Mastering Complex Conversations” (MCC) module. Participants were asked to rate their “before and after” skills and understanding about specific topics that were included in this module.

Participants reported learning gains in each component of the MCC module. The largest gains among participants in the in-person workshops related to “understanding the difference in jargon,” while the largest change for those who attended the online meeting was “ability to be an active listener.” Overall, participants who attended this module in-person reported greater increases in understanding, compared to those who attended the online training.

Though the differences were not significant, it may be possible that demographics explain in part why the in-person groups reported a higher difference score compared to the online groups. The in-person participants were generally younger and had less average work experience than the online participants. Their relative inexperience may make the in-person participants more likely to find this topic new and useful, compared to the more experienced participants in the online training. This is a topic for future exploration, as we consider these data in the context of a larger training dataset.

**Table 2 – MCC Module Learning Evaluation**

| Component of Learning  | In-Person Meeting |       |            | CARCC Online Training |       |            |
|--|-------------------|-------|------------|-----------------------|-------|------------|
|  | Before            | After | Difference | Before                | After | Difference |
| Ability to communicate clearly in a variety of contexts            | 3.50              | 4.13  | 0.63       | 3.5                   | 3.7   | 0.2        |
| Ability to be an active listener                                   | 3.38              | 4.12  | 0.75       | 3.7                   | 4.3   | 0.6        |
| Ability to provide constructive feedback                           | 2.88              | 4.00  | 1.13       | 3.7                   | 4.2   | 0.5        |
| Ability to identify and accommodate different communication skills | 2.88              | 4.00  | 1.13       | 3.3                   | 3.7   | 0.4        |
| Understanding the difference in “jargon”                           | 2.63              | 4.13  | 1.50       | 4.0                   | 4.5   | 0.5        |

Of obvious relevance is the different modality: we are less swayed by this interpretation, primarily because to the degree possible, we controlled for previous experience in online training in our analysis. The professionals in the online group reported high-degrees of confidence and experience in accessing online training, including the use of Video Conferencing (VC) tools. When asked to evaluate the VC format, they agreed that it is effective in maintaining their attention, facilitating discussion with peers and

interaction with trainer (average score of 4.2). One participant noted that VC could work effectively for this type of training topic.

To explore these differences more fully, we ran paired t-tests to gauge the statistically significance of any differences. We found that the p-value of all five learning components were below .05, except the component of “ability to communicate clearly in a variety of contexts” in the online group. The overall result still shows that the difference in the pre- and post-test were statistically significant, which suggests that this evaluation efforts indicates a noted impact on participants in the “Mastering Complex Conversations” module, for both in person and online audiences.

Table 3 presents participants’ self-reported interest, knowledge, and confidence in effective communication before and after the training. The result shows that the average score of each element went up after the training. As with other aspects of the module, we ran statistical analysis to assess any significant in the differences. With regards to the in-person group, a repeated-measures t-test found the result is significant for the knowledge and confidence, but not for interest. This suggests that the training did not change participants’ level of interest in the topic, but that participants do feel they gained new knowledge and increased confidence in their abilities around a particular topic by taking part in this training.

**Table 3 – MCC Module Interest, Knowledge, and Confidence**

| Component of Learning   | In-Person Training |       |            | Online Training |       |            |
|---|--------------------|-------|------------|-----------------|-------|------------|
|   | Before             | After | Difference | Before          | After | Difference |
| Interest in the topic of communication skills   | 3.50               | 3.88  | 0.38       | 3.9             | 4.33  | 0.43       |
| Knowledge of the topic of communication skills  | 3.00               | 3.88  | 0.88       | 3.6             | 4     | 0.4        |
| Confidence in your ability to effectively communicate with a team of peers in your area of expertise          | 3.38               | 4.00  | 0.62       | 3.8             | 4.1   | 0.3        |
| Confidence in your ability to effectively communicate with a team of peers with a different area of expertise | 3.00               | 3.88  | 0.88       | 3.7             | 4.1   | 0.4        |

In terms of the online workshop, the results demonstrate statistically significant gains in interest, knowledge, and confidence in communication with peers of different disciplines. However,

changes in confidence in communicating with peers with the same disciplinary expertise for the online group was not statistically significant. We interpret this to mean that the training did not cause the working professionals in the online group to feel any more inclined or empowered to communicate effectively with people in the same field, but that the training did help the online participants feel more confident and informed in their ability and desire to communicate with people outside of their specific area. Given that fostering interdisciplinary communications is a primary goal for the CyberAmbassadors project, we find these early data encouraging.

Lastly, participants offered a number of interesting responses when they were asked to give examples of how they would implement knowledge gained in the workshop. Some of them planned to apply this knowledge when interacting with their peers, customers, researchers, and users. Others planned to use this knowledge when working with people from a different area of expertise. Others indicated that they would apply knowledge from this workshop when becoming an officer, a trip leader, or a design group facilitator, and one participant mentioned that this workshop provided a good foundation for other training programs they would like to attend in the future.

### 3 Lessons Learned

In addition to our research findings and the continuous improvement of the core curriculum, many interesting lessons have emerged from these pilot studies. We share key lessons here.

**Live/online workshops:** We were surprised to find that the Video Conferencing method had advantages compared to the face-to-face method for participants. Participants suggested, when used properly, that online training is more convenient for busy people, enables the trainers to reach a wider audience, and provides a more relaxed environment. Our participants have indicated that the interactive online learning offered by the CyberAmbassadors program (which combines lecture, large group discussion and small group activities – all via video conference) can be as effective as in-person workshops. Participants also indicated that they are generally as satisfied by online modalities as they are with in-person training.

**Network for Training the Trainers:** In the original proposal this project included a plan to train a network of facilitators in the third year. However, in conversations with other training programs such as Tau Beta Pi’s Engineering Futures program [18] and the Entering Mentoring program [3], we have discovered a broader need for curriculum to train facilitators on how to effectively conduct these types of professional skills workshops. We now plan to develop a versatile Train-the-Trainers curriculum for professional skills training, similar to the technical skills train-the-trainers program developed by The Carpentries projects [13,15].

**Content Management System for Open Source Educational Materials:** One early goal for this project is to build an online system that is easy for facilitators to explore and find/modify educational content to fit their needs. Any modified content should then be easy to share back with the community. At the same time, the content should be secure and easy to maintain. Instead of recreating the wheel, we researched multiple content management systems (e.g. Pelican, Jekyll, Druple, Wordpress). Table 4 shows the results of our comparisons. Based on our research we have chosen to take advantage of the Jekyll templates provided by The Carpentries project [13,15], and modify them

slightly to suit the needs of these new learning communities. The CyberAmbassador curriculum is hosted using a Jekyll-based, static CMS. We encourage other OpenSource curriculum developers to also adopt this as a common standard.

**Table 4 – CMS Comparisons**

|                           | <b>Jekyll</b>                           | <b>Pelican</b>                             | <b>Wordpress</b>                      | <b>Drupal</b>                         |
|---------------------------|---|--|---------------------------------------|---------------------------------------|
| <b>Content State</b>      | Static                                  | Static                                     | Dynamic                               | Dynamic                               |
| <b>Core Language</b>      | Ruby                                    | Python                                     | PHP                                   | PHP                                   |
| <b>Host Site</b>          | Github.io                               | Github.io                                  | Wordpress.org                         | Local Install                         |
| <b>Live Editing</b>       | Yes                                     | No   | Yes                                   | Yes                                   |
| <b>Community Editable</b> | Yes<br>(live with<br>github<br>account) | Yes<br>(through<br>github pull<br>request) | Yes<br>(live with<br>site<br>account) | Yes<br>(live with<br>site<br>account) |
| <b>Editing Language</b>   | Markdown                                | Markdown                                   | WYSIWIG                               | WYSIWIG                               |
| <b>Long term Security</b> | Very<br>Secure                          | Very<br>Secure                             | Requires<br>regular<br>updating       | Requires<br>regular<br>updating       |

## 4 Concluding Discussion

The CyberAmbassador program provides professional skills training to CI Professionals. The success of the program will be based on the quality of the curriculum, the experience and training of the facilitators, and how easy it is to deliver the curriculum to a broad audience. To this end, the CyberAmbassador team is working hard to develop a curriculum that is rigorously evaluated and demonstrates value for the CI Community. Early evaluation data, shared here, indicated that early participants in this training are generally reporting positive gains in learning and confidence about the topics as presented, and that different modes of delivery can be equally effective.

We interpret these early findings to affirm that our efforts to develop a high-quality, flexible set of training modules are taking the right approach. We are finding that the modules themselves need to be flexible, easily adaptable, and suitable for in-person as well as online delivery. We also plan to explore the impact of synchronous (which we have done) and asynchronous learning environments. The latter we will explore in beta testing.

Our intention is that by making the CyberAmbassadors curriculum OpenSource and building a network of trained facilitators we hope to establish a solid infrastructure and community that can easily sustain these materials beyond the lifetime of the NSF funding.

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