A Flexible Curriculum for Promoting Inclusion through Peer Mentorship

Heather Pon-Barry
Mount Holyoke College
South Hadley, MA
ponbarry@mtholyoke.edu

Audrey St. John
Mount Holyoke College
South Hadley, MA
astjohn@mtholyoke.edu

Becky Wai-Ling Packard
Mount Holyoke College
South Hadley, MA
bpackard@mtholyoke.edu

Barbara Rotundo
Mount Holyoke College
South Hadley, MA
barbara.rotundo@mtholyoke.edu

ABSTRACT

The MaGE Training curriculum prepares computer science students for the task of inclusive peer mentoring and teaching. The curriculum raises awareness of the role of social identity in learning, emphasizes active learning within computer science, and provides preparation for technical code review. This article presents an overview of the MaGE Training curriculum where it has been used to train six cohorts of near-peer mentors and its impact on more than 500 students at a liberal arts college. While rapid growth in course enrollments has presented many challenges, results suggest that the MaGE curriculum has helped to address some of these challenges by maintaining high quality feedback to, and close interaction with, introductory students. Effectiveness is evidenced through increases in mentor self-efficacy, positive impact on student belongingness and continued enrollment, and reports of buffering the instructor workload. The flexibility of the curriculum is supported through a set of modules that can be engaged with via in-person discussions or viewed remotely. This enables easier adoption of the curriculum for use at other institutions.

KEYWORDS

Peer mentor preparation; Inclusion; Effective learning; Modular curriculum

ACM Reference Format:
Heather Pon-Barry, Audrey St. John, Becky Wai-Ling Packard, and Barbara Rotundo. 2019. A Flexible Curriculum for Promoting Inclusion, through Peer Mentorship. In *Proceedings of the 50th ACM Technical Symposium on Computer Science Education (SIGCSE '19), February 27-March 2, 2019, Minneapolis, MN, USA.* ACM, New York, NY, USA, 7 pages. https://doi.org/10.1145/3287324.3287434

1 INTRODUCTION

Computer science (CS) programs are striving to become more inclusive and engaging of all students; the MaGE (Megas and Gigas Educate) Training curriculum focuses on inclusion as a key tool for creating a welcoming environment that fosters a community of learning, especially for students who may not initially see themselves as computer scientists or see themselves reflected in the existing computer science community. The course provides research-based instruction on effective learning (motivation, strategic learning, self-efficacy, and growth mindset), enabling peer mentors to strengthen their education toolkits by self-assessing their strengths, engaging in group discussions, practicing effective feedback strategies, and adjusting and stretching their personal perspectives on the computer science community as well as their technical peer code review skills.

The MaGE Training curriculum was developed in 2015. In three years, 72 undergraduate peer mentors in computer science at Mount Holyoke College have participated in the training, serving as mentors to 532 near-peer novice CS learners. This article describes the curriculum and its impact at Mount Holyoke College. The curriculum, structured as a flexible set of online modules, can be customized for in-person or remote participation over varying time spans; complete lesson plans are intended to be as self-contained as possible, offering clear instructions to the novice and expert alike. Curricular materials, including four formats from a half-day workshop to a half-semester course, are available online[1]. We discuss suggestions for others who wish to adopt the curriculum for use at their institution.

1.1 Motivation

Many new faculty members, although experts in their own fields of study, enter college classrooms without a research-based understanding of how novices learn. While faculty often draw upon their own learning experiences as a resource, this alone can be insufficient as students vary in their strengths, stumbling blocks, and strategies. Decades of research have demonstrated the value of faculty learning communities, where faculty deepen research-based teaching strategies, including active learning and and inclusive pedagogical strategies [7, 11].

Peer mentors come to the task with their own knowledge base; although less extensive than faculty, their experience is more recent. While some peer mentors may use their own intuition to reach a wide variety of students, just as many, if not more, appreciate the

SIGCSE '19, February 27-March 2, 2019, Minneapolis, MN, USA

ACM ISBN 978-1-4503-5890-3/19/02.
https://doi.org/10.1145/3287324.3287434

[1] https://sites.google.com/mtholyoke.edu/student-training-resources

opportunity to learn about best practices from the literature (such as [15]), from more experienced others (whether more seasoned peer mentors, lab directors, or faculty), and in colleagueship or consultation with other peer mentors [18]. Thus, providing training for mentors is beneficial [10]. Specifically, investing in peer mentors as a cohort can professionalize the program, leading peer mentors become ambassadors for the department, with better outcomes for both mentors and newer students [1, 4].

Beyond improving the general teaching effectiveness, which is important, we also grappled with increased enrollments in our introductory course; we wanted to maintain high quality feedback, as the first CS course is so important to a student continuing on [3]. Furthermore, our college student population is racially and socioeconomically diverse–and almost exclusively women–while the computer science field historically has not been. Peer mentoring as well as peer-led team learning in introductory CS courses have been shown to increase enrollment, performance, and retention of students from underrepresented groups [8, 14]. We wanted to take an intentionally inclusive approach to our preparation of peer mentors in order to deliberately invite student participation.

With this motivation in mind, the MaGE Training curriculum is designed to enable peer mentors to hone their technical skills, improve their knowledge of learning processes, and develop their understanding of the fundamentals of effective peer mentoring and inclusive pedagogy, all of which will improve their teaching effectiveness with increasingly diverse student populations.

1.2 Context

With growing student interest (echoing national trends), our Computer Science department faced the challenge of meeting capacity demands with limited resources. As a women's liberal arts college, we aimed to scale our CS offerings while maintaining quality feedback when teaching a diverse community that includes groups traditionally underrepresented in CS. The MaGE program was designed to address these challenges because we were particularly cognizant of the importance of the quality of the introductory computer science course experience in students' decisions to persist [3, 16].

2 MAGE TRAINING CURRICULUM

The MaGE Training curriculum prepares students for the task of peer mentoring and teaching others inclusively. This training course raises awareness of the role of social identity in learning, emphasizes active learning within computer science, and provides preparation for technical peer code review. The curriculum was developed by computer science faculty in collaboration with a colleague in psychology and education who has research expertise in motivation, identity, and mentoring diverse student populations [15].

The core curriculum is grouped into the following modules:

- Learning processes (including self-regulated learning, active learning, peer instruction)
- Motivational factors that promote learning (including self-efficacy, growth mindset)
- Effective feedback and emotional intelligence
- Inclusiveness and climate

The module dependencies are shown in Figure 1.

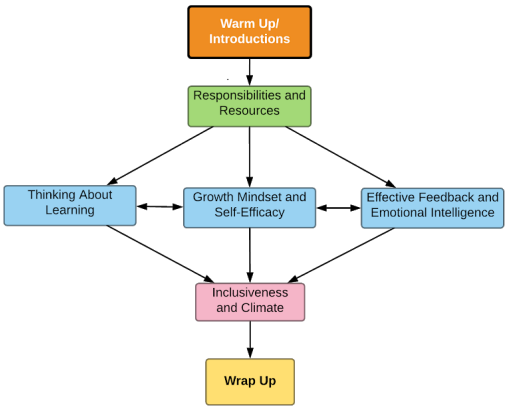

Figure 1: Core modules in the MaGE Training curriculum.

Each module is comprised of a set of curricular materials intended for instructors who are new to engaging with these topics. These materials include:

- A topic overview that introduces concepts, terminology, and tips for instructors
- Relevant readings including primary research articles
- Lesson plans for in-class activities, discussion question prompts, case scenarios for reflection and discussion, and handouts
- A flowchart showing the recommended order of the subtopics within the module, for example, Figure 2 shows the flowchart for the growth mindset and self-efficacy module

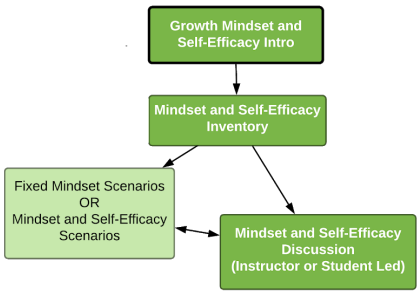

Figure 2: Recommended order for leading the growth mindset and self-efficacy modules. Darker modules are the highest priority if time is limited.

We anticipate that institutional constraints will impact the way others might engage with the curriculum and have been deliberate to maintain flexibility in this modular approach. Whenever possible, we provide multiple options within a module for engaging with the material. For example, a topic introduction could be a short video or a set of scholarly papers. Section 5 discusses this in more depth.

We also include suggested strategies for facilitating discussions and helping peer mentors engage with and reflect upon the topics, for instructors who are more comfortable with traditional lecture-based classroom environments than discussion. The material is

intended to be as self-contained and "off-the-shelf" as possible to allow for minimal overhead when adopting the curriculum.

2.1 Sample Training Schedule

An example schedule for a single full-day (approximately 8-hour) training session is outlined below. This schedule includes a subset of activities from all of the modules. Lesson plans are included for each activity.

```
Introductions [10 min]
Guidelines and Expectations [10 min]
Technology Pact [10 min]
Ice-breaker: Tell Me Something [15 min]
Initial Reflection About Learning [10 min]
Talking About Learning [30 min]
Break
Mindset and Self-Efficacy Intro [10 min]
Mindset and Self-Efficacy Inventory [10 min]
Mindset and Self-Efficacy Scenarios [30 min]
General Discussion on Mindset and Self-Efficacy [20 min]
Lunch
Criticism and Tone [15 min]
Discussing Effective Feedback [15 min]
Coach vs Mirror [10 min]
Trying Out the Coach and Mirror Roles [10 min]
Thinking About Roles [15 min]
Naming Emotions Worksheet [5 min]
What is Emotional Intelligence [10 min]
Why does Emotional Intelligence Matter [30 min]
Emotional Intelligence Scenarios [30 min]
Break
Pet Peeves and Pop Ups [20 min]
Climate and Learning Outcomes [20 min]
Universal Design for Learning [20 min]
Intersectionality and Lived Experience [30 min]
Bringing It All Back [15 min]
Framing [20 min]
Exit Feedback [10 min]
```

2.2 Sample Lesson Plan

An abridged lesson plan for the *Climate and Learning Outcomes* activity is shown below.

Topic: Inclusiveness and Climate
Approximate Time: 20 – 30 min
Ideal Group Size: 2 – everyone
Summary: Facilitate discussion about the ways our learning environment influences how effectively we learn
Objectives:

- Start students reflecting about their own experiences with classroom climates
- Encourage students to reflect on the experiences of others

Potential prompts:

- Can you think of a time when you felt as though you didn't belong in a class? Why do you think you felt that way? Were there things that the instructor or other students did to make you feel that way (or make the feeling stronger)? What impact do you think that had on your ability to learn effectively in that class?
- Can you think of a time when you felt very at home in a class? What contributed to your comfort level? What did you have in common with the instructor or the other students?
- Have you noticed any patterns for when you're likely to feel comfortable in a class and when you're likely to feel out of place? Is it related to the subject? The way the class is being taught? Your own level of knowledge going in? Feeling like the only person of a certain identity in the room?
- Based on the conversations we've had so far, can you think of things that you can do (or avoid doing) to help other students feel comfortable?

3 ESTABLISHING MAGE

We created the MaGE Training curriculum as a *precursor* to establishing the MaGE peer mentorship program. While the initial curriculum was specifically tailored to our program mentors' responsibilities, we have revised the materials to enable its use by a broader audience. We envision that the curriculum will be useful both for establishing new mentorship programs, as well as augmenting established mentoring programs or teaching assistant training.

At our institution, trained peer mentors work with a small (6-9 person) group of CS1 or CS2 students for a whole semester. At regular intervals[2], the peer mentors perform written code reviews on completed student assignments and give feedback in one-on-one 10-minute meetings. Some mentors additionally lead active learning lessons or assist with student questions in lab sections. The cohort of peer mentors meets weekly for a MaGE Practicum course with the program coordinator and a faculty member to discuss topics related to the MaGE Training course and further develop as mentors.

The MaGE program was initially supported by external funding. The goal was to address rising enrollments while maintaining close interactions and feedback in the introductory courses without requiring additional staffing for multiple sections of the course. The MaGE program leverages a peer mentorship solution. Providing peer mentors with a rigorous foundation in both pedagogical approaches and technical skills can create an inclusive and supportive climate that empowers a diverse population of students to learn effectively, with positive outcomes for the peer mentors' developing leadership and longer-term trajectories [13]. To develop the MaGE program, we looked to existing programs with similar goals in the literature, at other institutions, and on our campus. Past research supports the use of a seminar-style course to organize and deliver the peer mentor training [19]. On our own campus, we were inspired by the success of a half-semester, seminar-style course to train peer mentors for another program and worked closely with the director of that program to understand the structure, benefits and potential stumbling blocks to bear in mind when creating our own. The factors we considered varied from student motivation and selection to approval requirements for credit-bearing courses to logistical questions of scheduling. We also drew upon literature of previous efforts to support peer-led workshops (e.g., [12]) as our peer mentors were expected to lead active learning workshops, in addition to engaging in peer code review.

[2]For the 2015-2018 period reported on in this paper, the feedback and meetings occurred weekly.

Table 1: Teaching self-efficacy changes among peer mentors 2016–2017.

Item: "I am confident in my ability to…"	Pre-survey mean	Post-survey mean	significance
Create a positive climate for learning	3.81	4.19	t(47)=4.31, p<.01, d=.63
Promote a positive attitude towards learning in my students	4.04	4.34	t(47)=2.25, p<.06, d=.32
Provide support to students who are having difficulty learning	4.15	4.47	t(47)=2.90, p<.05, d=.42
Provide effective written feedback to students	3.85	4.36	t(47)=3.51, p<.01, d=.51
Provide effective feedback one-on-one	3.74	4.28	t(47)=4.70, p<.01, d=.69
Lead an active learning session	3.13	3.71	t(47)=6.19, p<.01, d=.90

Developing the initial curriculum was a collaborative process, drawing on the experience and perspectives of the computer science faculty and the expertise in effective learning and mentorship strategies from the faculty colleague in psychology and education. To kickstart the program, we first ran the training course as a "bootcamp" with a small group of students over a 10-day period immediately preceding the semester. Their feedback helped us refine the materials for the credit-bearing half-semester course, which has been offered for a three-year period. The course has counted towards the instructor's teaching load, which reduced the total courses that the department could offer. We are still iterating to find the right balance and anticipate that increasingly modular, "off-the-shelf" materials will greatly reduce the time required to lead the course in the future.

4 OUTCOMES

4.1 On Mentors

Our findings demonstrate the efficacy of the training curriculum on student mentors. In-line with previous findings of improved teaching efficacy for mentors and teaching assistants [5, 9], we found that during Year 1, peer mentors grew in their teaching self-efficacy throughout the training and practicum, and the intro CS students consistently rated the mentors' knowledge, approachability, and flexibility/creativity as strong or very strong [17]. Intro CS students also credited the one-on-one sessions with peer mentors with improving their self-efficacy and understanding of material [16].

In this paper, in Table 1, we share the peer mentor analyses from Year 2. Based on repeated measures t-tests to analyze changes within individual mentors pre-to-post training, peer mentors grew significantly in their teaching confidence, with moderate (0.32-0.51) to larger (0.63-0.90) effect sizes.

Interviews with over 20 peer mentors provided additional insights about the value of the curriculum used in the training. Peer mentors emphasized that the curriculum provided 1) practice with the role; 2) a research foundation that provided useful explanations and helpful language, with an emphasis on growth mindset, self-efficacy, and feedback; and 3) a learning community to support their development as peer mentors. MaGE mentors shared that when they interviewed for internships or post-graduation employment, whether for technical or non-technical positions, they were able to speak in specific concrete terms about what they learned, such as teaching and working in diverse teams, providing and receiving feedback, and improving their technical ability to debug code. Therefore, the curriculum was not only useful for their role as peer mentors, but also transferred to new contexts of employment.

One powerful strategy leveraged in the training was to videotape the mentors as they provided mock one-on-one feedback to each other. Mentors viewed their own videos privately, and watched, in small groups, short video snippets of their peers' interactions. One mentor explained the value: "We saw each other's videos– seeing how other people introduced themselves helped. How they gave criticism– how they would make it better, and make it more effective." Another voiced the importance of being able to practice a mock active learning module (ALM), sharing "the most valuable experience in the preparation course was doing the mock ALM– public speaking is a concern of mine...having experience and doing it in a safe environment in front of your peers is so helpful."

4.2 On Introductory Learners

The MaGE program was introduced initially in CS1 in the 2015-16 academic year, then in CS2 in the 2016-17 academic year. In these same years, course enrollments and the total number of computer science majors rose rapidly at our institution as well as nationally [2]. Table 2 shows the enrollment growth in CS1 and CS2 from 2014 through 2018.

Table 2: Increases in enrollment in CS1 and CS2 from 2014–2018. The bolded values indicate the years with MaGE mentors integrated into the courses.

Academic Year	CS1 enrollment	CS2 enrollment
2014–15	90	56
2015–16	**122**	83
2016–17	**123**	**77**
2017–18	**138**	**72**
2018–19	**165**	**113**

In this context of enrollment growth, the course-by-course student retention from CS1–CS2 and CS2–CS3 show increased retention rates upon the introduction of MaGE. Table 3 shows these retention estimates (data is based on course enrollment numbers rather than tracking of individual students; 2018–19 retention data is for half the year).

We observe that during the years after implementing this new curriculum, the retention from CS1–CS2 improved, was maintained, and recently has risen. For the CS2–CS3 transition, which reflects

Table 3: Retention proportion of first to second course (CS1–CS2) and second to third course (CS2–CS3). The bolded values indicate the years with MaGE mentors integrated into the courses.

Academic Year	CS1–CS2	CS2–CS3
2014–15	0.46	0.73
2015–16	**0.60**	0.78
2016–17	**0.62**	**0.88**
2017–18	**0.60**	**0.68**
2018–19*	**0.76**	**0.88**

the conversion to a computer science major, we observe a peak, a dip, and then a return. This dip is likely due to limitations on instructor staffing and the number of course sections offered. Open-ended survey responses suggest that retention was supported by the encouragement and personalized feedback from mentors. In one student's words, "[My mentor] helped me a lot in terms of emotional support. She motivated me whenever I thought CS was so challenging that I could not continue." In another's: "Any questions I had about the course material or computer science in general my mentor was able to answer. Moreover, my mentor boosted my confidence and made me feel like I was good enough at computer science to continue on in the program." We saw the peer mentors as normalizing the challenges faced by students in computer science, so introductory students were less likely to internalize the struggles as something inherently problematic with them as individual learners of computer science.

Survey data collected at the end of each semester from the novice students who were mentored in the MaGE program further supports the impact of mentors on student confidence. The percentage of students completing the end-of-semester surveys ranged from 63% to 89%. Table 4 shows mean student responses to the following statements: *"My mentor's written feedback contributed to my confidence with the material"*, *"The weekly meetings with my mentor contributed to my confidence with the material"*. A 6-point scale was used, with 1 indicating 'strongly disagree' and 6 indicating 'strongly agree'. The data shows consistently high levels of agreement for both CS1 and CS2 students over the two-year assessment period from 2016-2018, suggesting their validation of the quality of the mentoring and by extension the impact of the MaGE training curriculum.

Table 4: Introductory students' ratings of mentor contributions to improved confidence.

Course	Acad. Year	Written feedback	In-person meetings
CS1	2016–17	4.99	4.98
CS1	2017–18	5.34	5.42
CS2	2016–17	5.59	5.51
CS2	2017–18	5.12	5.23

Another goal of the MaGE curriculum is to foster a community where novice students feel a sense of belonging. Students were surveyed at the start and end-of-semester using a survey of belonging [6]. Students indicated their level of agreement, on the same 6-point scale, with the following statements: *"I feel that I belong to the computer science community"*, and *"I feel a connection with the computer science community"*. Table 5 shows the mean responses, indicating increased sense of belonging in all but one of the groups reported. It is possible that belonging increased over time due to other factors beyond the peer mentoring. However, we underscore the student open-ended comments pointing to the contribution of the peer mentors as at least a contributing factor. One student explained: "I not only learned CS from my mentor, I also learned more about Mount Holyoke as a school and formed a community with my mentor and fellow students."

Table 5: Introductory students' increased belonging and connection ratings 2016–2018.

Course	Acad. Year	belong pre	belong post	connect pre	connect post
CS1	2016–17	3.92	4.23	3.76	3.95
CS1	2017–18	3.21	3.96	3.19	3.77
CS2	2016–17	4.36	4.33	4.28	4.29
CS2	2017–18	4.22	4.35	4.20	4.31

4.3 On Instructors

We found that the instructors of CS1 and CS2 were able to reduce their workload, even for larger class sizes, due to (1) less time providing technical feedback, given initial mentor code reviews, (2) embedded mentors in labs eliminating the need for faculty instructors to be present alongside lab instructors, and (3) fewer students requesting support via office hours, appointments and emails. In addition, engaging in the MaGE Training curriculum alongside students provides instructors with an opportunity to acquire a framework for more effectively interacting with a diverse group of students. As one instructor noted, "Preparing to teach the MaGE training course had a profound impact on me, my relationships with my colleagues and students, and my teaching style. I've always viewed myself as personable, empathetic and understanding of difference. This course helped me to see that there is no endpoint for emotional intelligence and that my empathy was biased in favor of situations I had personally experienced. I realized that, while understandable, addressing my biases would help me grow as an educator and fundamentally shape my students' experiences."

4.4 At the Institution

Modules from the MaGE curriculum are being piloted on campus more broadly, as the core topics focus on effective, inclusive teaching and learning strategies. Some modules have been already been incorporated into an introductory mathematics class and into the training for mentors who assist peers in oral and written communication skills. A new course for preparing peer mentors embedded in the campus makerspace has been closely structured around the MaGE curriculum. A group of STEM faculty plan to adapt the half-day workshop materials for training their TAs and mentors. We are

currently collecting reports of how other campuses (larger research universities as well as small colleges) are modifying the modules to suit the needs of their own peer mentor or TA preparation, in and beyond computer science.

5 PRACTICAL SUGGESTIONS FOR ADAPTING THE FLEXIBLE MAGE CURRICULUM MODULES

The curriculum is designed to be as modular as possible, providing flexibility for those wishing to adopt it. Materials are intended to be as instructional and self-contained as possible, so that a lack of familiarity with the associated topics is not a barrier to adoption. Indeed, we have observed that instructors engaging alongside their mentors as fellow learners can result in more robust and meaningful interactions. Factors that should be taken into consideration when choosing curricular modules include logistical constraints, mentor responsibilities and prioritization of training goals. While we designed the course originally around 7 weekly 3-hour sessions, we provide additional curricular formats for single-day, half-day or 5 hourly sessions on our website[3].

Logistical constraints and facilitating discussion. The *number of mentors* has an impact on the delivery of discussion-based modules; we have found groups of about 12-15 allow for a level of trust and familiarity to be established that leads to deeper conversations. When working with a large group of mentors, we suggest breaking into smaller groups and, if possible, having a facilitator for each; facilitators could be instructors or previously trained mentors, suggesting that this model can be scaled. The curricular materials include tips for how to facilitate inclusive discussions, as well as suggestions for different formats. While we have only delivered the curriculum to groups of students in the context of one *discipline*, most of the topics are more universal, so training mentors across a variety of disciplines may be possible. We suggest being mindful, however, of discipline-specific factors that may impact the discussions; for example, gender identity may play a different role when considering mentorship of computer science students versus biology students. There may be particular technical nuances as well, such as a focus on debugging errors that are difficult among novice learners as compared to those at a more advanced level.

Schedule constraints pose limitations on in-session activities, pre-session requirements and post-session reflections. Whenever possible, we provide choices on how to engage with a module; for example, in-session short videos may be chosen to introduce a topic instead of more scholarly pre-session articles if training does not allow for multiple meetings or assigned work.

Mentor responsibilities. The MaGE mentors held an array of responsibilities, from providing on-the-fly assistance in lab to written and oral feedback on completed work (1-on-1 meetings founded in a code review) to leading active learning group activities. When adapting the curriculum, choose topics that align with the responsibilities of the mentors being trained; e.g., if mentors are only performing code review (and not directly interacting with students), the module on emotional intelligence may be less important than the module on effective feedback. We suggest targeting activities to the specific responsibilities that mentors will undertake. For example, we used mock 1-on-1 meetings to prompt reflection on the mentorship role our students would undertake; for a program where mentors only interact with larger groups of students, a different activity (e.g., modeling a short interactive lecture) would be more appropriate. Whatever the activity, we found that videotaping it followed by independent (private) reflection and small group discussion of clips was often the training experience mentors found most impactful.

Training goals. When choosing and structuring training sessions for peer mentors, it helps to list and prioritize the goals for the program and convey them to the mentors. Are mentors reducing workload on faculty and staff (e.g., via code review)? Is the program aiming to create a more inclusive climate to increase representation of underrepresented groups? Do intended outcomes include cohort-building or construction of a supportive community? The curriculum is designed to have flexibility for embedding skill-based activities throughout, training students in specific responsibilities as well as providing material for reflection and discussion about the more abstract pedagogical topics. For example, if mentors will be performing code review, we suggest pairing mock code review with a discussion around providing effective feedback in inclusive ways.

Structure and flow. The suggested formats are a starting point for structuring the topics and finding a flow that is most effective. An initial discussion about mentorship, particularly regarding program goals, followed by the modules on thinking about learning (e.g., topics of self-regulated learning, self-efficacy and mindset) can organically prompt reflection around the importance of inclusive approaches to mentorship. We noticed that placing these discussions and reflection opportunities before explicitly addressing the role of identity helped establish a group dynamic where participants were more open to digging into the deeper and often more difficult discussions. As many campuses have the goal to improve racial, gender, and socioeconomic diversity, among other identity dimensions, having the capacity to talk among peer mentors and TAs, as well as department instructors more generally, is critically important to reach these goals.

6 CONCLUSION

Asking how one's department, college, or university curriculum serves to invite a wide variety of learners to participate in the broader learning community, and sustain challenge, may be facilitated by engaging TAs and peer mentors in the process. These seasoned and more advanced students often act as ambassadors to our majors and programs of study. Equipping them to be effective technical and inclusive teachers is an important step in the right direction. This paper offers an overview of the MaGE Training curriculum and evidence of the efficacy of the program for the peer mentors, introductory learners, and instructors. The flexibility of the modules facilitates customization for different campuses and uses within and beyond computer science. The online availability also increases access. Importantly, the curriculum addresses effective learning and inclusivity goals which are important on the national level. Adapting the curriculum and sharing the outcomes of similar initiatives can only help computer science to reach collective expansion and diversity goals.

[3]https://sites.google.com/mtholyoke.edu/student-training-resources

ACKNOWLEDGEMENTS

This work was funded by a Google CS Capacity Award. We are grateful for the support of Mount Holyoke College, the computer science department, and all the students who have participated in MaGE and shared their feedback with us.

REFERENCES

[1] Thalia Anagnos, Alicia Lyman-Holt, Claudia Marin-Artieda, and Ellen Momsen. 2014. Impact of engineering ambassador programs on student development. *Journal of STEM Education: Innovations and Research* 15, 3 (2014), 14–20.

[2] Computing Research Association. 2017. Generation CS: Computer Science Undergraduate Enrollments Surge Since 2006. http://cra.org/data/Generation-CS/ Accessed November 28, 2018.

[3] Sylvia Beyer. 2014. Why are women underrepresented in computer science? Gender differences in stereotypes, self-efficacy, values, and interests and predictors of future CS course-taking and grades. *Computer Science Education* 24 (2014), 153–192.

[4] Bethany Bowling, Maureen Doyle, Jennifer Taylor, and Alison Antes. 2015. Professionalizing the role of peer leaders in STEM. *Journal of STEM Education* 16 (2015), 30–39.

[5] Sue Ellen DeChenne, Larry G. Enochs, and Mark Needham. 2012. Science, technology, engineering, and mathematics graduate teaching assistants teaching self-efficacy. *Journal of Scholarship in Teaching Learning* 12 (2012), 102–123.

[6] Catherine Good, Aneeta Rattan, and Carol S. Dweck. 2012. Why do women opt out? Sense of belonging and women's representation in mathematics. *Journal of Personality and Social Psychology* 102, 4 (2012), 700–717.

[7] Charles Henderson, Andrea Beach, and Noah Finkelstein. 2011. Facilitating change in undergraduate STEM instructional practices: An analytic review of the literature. *Journal of Research in Science Teaching* 48, 8 (2011), 952–984.

[8] Susan Horwitz, Susan H. Rodger, Maureen Biggers, David Binkley, C. Kolin Frantz, Dawn Gundermann, Susanne Hambrusch, Steven Huss-Lederman, Ethan Munson, Barbara Ryder, and Monica Sweat. 2009. Using peer-led team learning to increase participation and success of under-represented groups in introductory computer science. In *Proceedings of the 40th ACM Technical Symposium on Computer Science Education (SIGCSE '09)*. ACM, New York, NY, USA, 163–167. https://doi.org/10.1145/1508865.1508925

[9] Sarah Hug, Heather Thiry, and Phyllis Tedford. 2011. Learning to love computer science: Peer leaders gain teaching skill, communicative ability and content knowledge in the CS classroom. In *Proceedings of the 42nd ACM Technical Symposium on Computer Science Education (SIGCSE '11)*. ACM, New York, NY, USA, 201–206. https://doi.org/10.1145/1953163.1953225

[10] Christina Algiere Kasprisin, Peg Boyle Single, Richard M. Single, and Carol B. Muller. 2003. Building a better bridge: Testing e-training to improve e-mentoring programs for diversity in higher education. *Mentoring & Tutoring* 11, 1 (2003), 67–78.

[11] Clifton Kussmaul. 2012. Process oriented guided inquiry learning (POGIL) for computer science. In *Proceedings of the 43rd ACM Technical Symposium on Computer Science Education (SIGCSE '12)*. ACM, New York, NY, USA, 373–378. https://doi.org/10.1145/2157136.2157246

[12] Janet Liou-Mark, A. E. Dreyfuss, and Lori Younge. 2010. Peer assisted learning workshops in precalculus: An approach to increasing student success. *Mathematics and Computer Education* 44 (2010), 249–260.

[13] Marina Micari, Army Knife Gould, and Louie Lainez. 2010. Becoming a leader along the way: Embedding training into a large-scale peer learning program in the STEM disciplines. *Journal of College Student Development* 51, 2 (2010), 218–230.

[14] Tia Newhall, Lisa Meeden, Andrew Danner, Ameet Soni, Frances Ruiz, and Richard Wicentowski. 2014. A support program for introductory CS courses that improves student performance and retains students from underrepresented groups. In *Proceedings of the 45th ACM Technical Symposium on Computer Science Education (SIGCSE '14)*. ACM, New York, NY, USA, 433–438. https://doi.org/10.1145/2538862.2538923

[15] Becky Wai-Ling Packard. 2016. *Successful STEM mentoring for underrepresented students: A research-based guide for faculty and administrators*. Stylus Publishing, Sterling, VA.

[16] Heather Pon-Barry, Audrey St. John, Becky Wai-Ling Packard, and Chris Stephenson. 2017. Addressing the CS capacity challenge by improving undergraduate peer mentoring. *ACM Inroads* 8, 3 (2017), 43–47. https://doi.org/10.1145/3123732

[17] Heather Pon-Barry, Becky Wai-Ling Packard, and Audrey St. John. 2017. Expanding capacity and promoting inclusion in introductory computer science: A focus on near-peer mentor preparation and code review. *Computer Science Education* 27, 1 (2017), 54–77. https://doi.org/10.1080/08993408.2017.1333270

[18] Bernhard Streitwieser and Gregory Light. 2010. When undergraduates teach undergraduates: Conceptions of and approaches to teaching in a peer led team learning intervention in the STEM disciplines: Results of a two year study. *International Journal of Teaching and Learning in Higher Education* 22 (2010), 346–356.

[19] Lydia T. Tien, Vicki Roth, and J.A. Kampmeier. 2004. A course to prepare peer leaders to implement a student-assisted learning method. *Journal of Chemical Education* 81 (2004), 1313–1321.