Tapestry Workshops: Helping High School Teachers Grow and Diversify Computing

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Abstract

The Tapestry Workshop series helps high school Computer Science teachers inspire diverse students to learn computer science. The workshops are offered to high school educators who want to initiate, expand, or improve Computer Science instruction in their schools. Eight colleges and universities have already organized workshops and three more will do so in summer 2013. Ongoing evaluations show that these workshops are highly effective in increasing the enrollment and diversity of the participating educator's computer science classes. We discuss motivations for the workshops; how they are organized; necessary content; the nationwide partnerships for offering workshops; and results from the ongoing evaluation of the workshops.

A different type of professional development

The Tapestry Workshop series promotes high school computer science by helping teachers inspire diverse students to learn computer science. Each workshop runs for two and a half days in the summer. Participants are high school computer science teachers and other educators (e.g., principals and math teachers) who want to initiate or expand computer science instruction in their schools. Built on a successful model developed at the University of Virginia, Tapestry Workshops have been offered at seven additional colleges and universities in 2011 and 2012 and three more schools are slated for 2013.

Unlike other many other high school teacher computer science workshops, the Tapestry Workshops do not teach computer science; rather they focus on computer science education and broadening participation. Attendees learn effective pedagogical practices for teaching computer science to *all* students. In addition to pedagogy, attendees are introduced to recruiting strategies that encourage students in general and women and minorities in particular to take computer science classes.

Evaluation shows that participants both value the experience and make successful use of what they learned in the workshop. All but two of 223 participants from the 2011 and 2012 workshops indicated that they would recommend the workshop to colleagues. Individual sessions provided credible and useful information according to immediate post-workshop surveys. Moreover, there is evidence that the workshops increased the number and diversity of high school students studying computer science in the participants' schools.

In the following we discuss the importance and structure of the Tapestry Workshops. We discuss how workshops are organized; the content presented in typical workshops; the nationwide college and university partnerships for offering Tapestry Workshops; and results from the ongoing evaluation of the Tapestry Workshop series.

We begin with our motivation in offering the workshops: high school computer science education is foundering.

Motivation: High school is a leverage point for the crisis in computing

High school is a critical intervention point in student selection of discipline and career. Nationally, however, we do a poor job of promoting student, especially girls', interest in computing. In 2011, the Advanced Placement Computer Science (AP CS) exam was offered in fewer than three thousand high schools. From those schools, only 23,000 students took the AP CS exam that year. This number is less than 8% of the 340,000 students taking an AP Calculus exam. Except for one advanced-topics Physics exam, the AP CS exam has the least number of takers of any science, technology, engineering, and mathematics (STEM) AP exam. In addition, the AP CS exam has the worst gender balance of any AP exam given by the College Board (CB) — women comprise less than 20% of test takers.

The current situation inhibits late-comers at the college level by decreasing the likelihood they will succeed. College introductory courses typically assume that students have some programming experience – many do. The range of experience levels creates a situation where able students can feel intimidated by those who appear to be more talented in computing by virtue of their experience. This situation particularly disadvantages the women and minority students, who are more likely to be true novices. In addition, or perhaps partially because of this intimidation, experienced students get better grades in introductory computer science courses.[3,12,13] It is also the case that students with AP computer science credit are more likely than other students to major in computer science.[18] Thirty-two percent of CS AB test-takers major in computing, compared with only three percent of students who never took AP Computer Science in high school. Furthermore, unpublished data collected by Sonnert and Sadler show that high school is an important time for developing education and career goals. The majority of students majoring in science, technology, engineering, or math made that decision during high school.[17]

Many high schools contribute to the low numbers and gender imbalance through non-existent CS courses or by mislabeled non-CS offerings, such as keyboarding, with the CS label. High schools also often lack teachers trained in the CS subject area, are unaware of the gender issues in computing, and engage in minimal efforts to recruit students into CS. Numerous calls for improvement point to a need for:

- Access to high quality computing experiences,
- Public understanding of what computing really is,
- Course content,
- Teacher training,
- Education policies,
- Feeling of belonging for members of underrepresented groups.

High school teachers cannot take responsibility for these changes, however, without adequate training and supportive policies. Teachers need training in the theory and practice of both

computing and computing education, but they also need to understand computing's gender issues and methods for mitigating those issues.

The Tapestry Workshops are an attempt to change that landscape.

Workshop principles and organization

Defining features of Tapestry Workshops include:

- All organizers are committed to improving high school computer science education.
- All organizers are prepared and given resources necessary to run a successful workshop.
- Only evaluated or research-based practices that work with diverse students are presented. Evidence of effectiveness is provided for all recommended practices.
- Presented examples and resources are easily used and adapted without ongoing support or instruction.
- Inclusion of success stories by energetic high school teachers (local if possible) using recommended practices.
- Active learning components; e.g., group problem solving to facilitate workshop ice breaker activities.
- Sessions including:
    - Current conditions and need for computing in high school.
    - CS1-type course(s) that promotes more and diverse computing majors.
    - Recruiting techniques for more and diverse computing majors.
    - Pedagogical best practices that result in more and diverse computing majors (e.g., pair programming).
    - Teacher success stories.
- Time every day to reflect, plan for action, and share thoughts and experiences.
- Physical movement, especially as the end of the day approaches.
- Both at-workshop and follow-up evaluation of workshop efficacy and follow-up evaluation of participant outcomes,
- Participant compensation out of respect for their interest in improving high school computer science education and recognition of the value of their time.

Each of these principles is addressed in the following sections.

Organizer recruitment, selection, and preparation

The authors recruit and train organizers of individual workshops. Potential organizers are often recruited via personal contacts, mainly established through NCWIT interactions (e.g., the Extension Services community and the Academic Alliance) and through other professional networks and conference meetings. Those interested complete online applications[21] during the fall and are notified of acceptance before the end of the year. The selected organizers demonstrate prior commitment to computer science diversity and are part of institutions that can provide the support and infrastructure needed for a successful workshop.

To prepare for hosting a workshop, organizers come to a weekend training meeting and are given assistance throughout the winter and spring in planning their own workshop. In the training meeting new organizers meet previous organizers and potential session leaders; are introduced to workshop elements, philosophy, and practices; and the established workshop infrastructure and available resources (e.g., application system, calendar and session templates, procedures, and funding) are detailed. In the following months we help review plans, answer questions, and provide general guidance as needed. New organizers also attend the summer's first Tapestry Workshop, which takes place at University of Virginia, so they can observe a correctly-functioning event. All this preparation helps organizers plan successful workshops.

In training we make sure to indicate potentially serious pitfalls that might reduce the effectiveness of the workshops. For example, we caution against:

- Presenters who lack respect for high school educators or diversity issues, or who cannot convey ideas in a clear and engaging manner.
- Repetition of the same information in more than one session.
- CS1 content that does not primarily focus on how to more effectively teach diverse students.
- Sessions devoted to activities outside mainstream curriculum and pedagogy, e.g., camps or after school programs.

This list, as all of our training material, is informed by personal experience running workshops as well as the findings of educational researchers.

Typical workshop content

The bulk of time in each workshop is spent on presentations and discussions ranging from 45–90 minutes in length. The session leaders are the Tapestry Workshops initiators, local workshop organizers and faculty, previous high school teacher workshop attendees, and visitors from NCWIT, CSTA, the NSF, and other supportive organizations.

The remainder of this section discusses some of the key topics presented in many of the workshops. Not every presentation fits into one of the topics below, and not every topic is covered in each workshop. We note that some presentations failed to achieve all we hoped they would, and each workshop brings some of its own flavor, focus, and presenters. Attracting and retaining female and diverse students is a theme that can be explored from many directions. Regardless of adjustments and customizations, certain characteristics define Tapestry Workshops, and the project leaders work to ensure fidelity as the workshops are replicated.

Current conditions and high school computing education

This session provides data on the need for computing education in high school and how attracting currently underrepresented students can help meet that need. In several cases, the first gender and computing session was a keynote talk, presented by a representative from the National Science Foundation. Beyond informing workshop participants, the content is intended

as a resource for teachers to use when talking with principals, parents, school boards, and colleagues about why computer science should be offered in their school.

After defining computing, its intellectual merit, and its wide ranging applications, the content of this session is primarily data showing the unmet need for computing professionals and how that need could be better met by drawing on women and minorities, populations that are severely underrepresented in computing. Bureau of Labor Statistics occupational projections are contrasted with Integrated Postsecondary Education Data System[15] reports on numbers of students earning degrees in computing. The contrast shows an extreme shortfall. Further, most other disciplines overproduce graduates compared with their anticipated job openings.

The shortfall in computing could be ameliorated by drawing on demographic pools other than the white males who comprise a minority of the college-going population. Trends in under representation are illustrated, making the point that women's participation in computing has changed over time. This condition has changed before, and so can be changed again.
Other keynote topics focus on the future of computer science education. Presentations have described and discussed the following important initiatives.

- The CS10K Project seeks to have ten thousand high schools with rigorous computing courses in the next few years. The CS Principles project is a companion effort to create widely accessible advanced-placement course exploring the breadth of computing to augment the existing advanced-placement course in programming.[14] These efforts have the potential for short-term impact on the attendees both as curricula they can use for introductory courses (see, e.g., curricula from Berkeley[4] and LA Public Schools[11]) and suggest that the College Board will accept CS Principles as the source material for an AP exam.
- The CSTA K-12 Computer Science standards[15] and the ACM/IEEE-CS Computer Science Curricula[9] define multi-leveled learning objectives for computer science courses. Most workshop participants use the College Board's AP exam topics or a personally-customized curriculum instead, but we mention these as possible avenues for administration and sources of ideas for rigorous computing course design.

Getting the tone of a presentation on the future of computer science education right can be difficult. While the content is inherently exciting to teachers who feel alone and overwhelmed, presentations can sometimes make the changes seem too distant to care about or so immediate that the delay of a few years is a serious let-down. We observe that effective presentations generally open with the predicted time scale and caveats about the uncertainty of that schedule to set expectations appropriately. They then focus on how elements of the unfolding plans can be put into practice today.

Gender and computing

The session on gender and computing provides research findings for key factors affecting women's representation. A major focus is on cultural stereotypes about gender and computing, and how stereotype threat reduces women's interest, confidence, feeling of belonging, and

identity as a "computing person." These characteristics also predict selection of a college major and subsequent occupation.

Understanding how the cultural context inhibits female enrollment in computing courses helps workshop participants realize why it is necessary to actively counter the status quo. Without intervention, high school girls are much less likely than boys to feel interested, confident they could succeed, like they belong, or like they are the kind of person who studies computer science. Active recruiting is necessary to overcome current stereotypes.

In addition to the need for active recruiting, teachers are urged to avoid creating conditions that invoke stereotype threat, and to take steps that reduce the negative effects of threats beyond their control. The teachers are encouraged to make use of self-affirmation and "wise" feedback, two methods for inhibiting threat-induced poor performance.[7] Attention is called to ways the participants unwittingly communicate stereotypes, for example, through use of terms like "geek" or through classroom decorations associated with "geekiness." Participants are often surprised by the extent to which they have been unintentionally excluding girls.

Evaluation of this session shows that 75% of the survey respondents strongly agreed that the information provided was useful (N=204) and over 60% of the 49 respondents to the summer 2011 follow-up survey indicated that they had used the information during the prior school year.

CS1 redesign

There have been several successful attempts in recent years to modify CS1 pedagogy and practices to make the curriculum interesting to diverse groups of people.[1, 19, 12] We always include a session with a CS1 instructor whose practices are particularly encouraging to women and minorities. The CS1X effort developed at University of Virginia has been of particular interest to high school computer science teachers because it is designed for people without prior CS1 programming experience. CS1X is organized around problem solving and uses a scaffolded, active learning, lab-centric approach for achieving mastery of concepts and skills.

A typical CS1 workshop session begins with some interesting and offbeat problem solving activity. The course mechanics and pedagogy are then introduced. Web repositories of the materials are made available. A session ends with a discussion of CS1 practices recommended by the attendees in preparation for the session. Somewhere during the session a statistic from an informal CS2 test 1 survey highlights that students with AP computer science outperformed all versions of college-level CS1, and that former CS1X students slightly outperformed students with other sources of CS1 exposure. We observe a noticeable air of pride that comes as teachers internalize that their efforts are successful.

Attendees consistently find the session useful; 76% of 223 workshop participants from 2011 and 2012 strongly agreed in the post-workshop survey that the information presented was useful and 61% of the 49 respondents to the 2011 follow-up survey indicated that they are using or adapting CS1X elements in their own courses.

Active Recruiting Techniques

There are generally two sessions on active recruiting, one focusing on relevant research, and the other presented by a teacher with success recruiting girls and minorities. As one of the most important topics in the workshop, this material is generally placed early in the agenda and is re-emphasized in past participant success stories and other workshop presentations.

The first session focuses on research that suggests success rests on sparking female students' interest, building their confidence, nurturing a sense of belonging, and providing opportunities for developing students' identities as "computing people." The second session focuses on the specific actions of an exceptionally successful high school computer science teacher. In both, speakers make clear that the most important aspect of recruiting is to do it: to actively invite students to participate in computing courses.

For example, the first session recommends sparking *interest* through engaging girls in projects they already want to undertake, and by highlighting computing's relevance for helping people, making the world a better place, saving the environment, as well as the many more applications of computing. Depending on their backgrounds, girls may also be particularly interested by occupational features such as flexibility, opportunity, rewards, and ability to give back to their communities. Workshop participants are encouraged to make use of the dotdiva.org website where market-tested language and images are available for showing girls the many exciting things they can do with computing knowledge. Teachers are also encouraged to nurture student *confidence* in three main ways inferred from work by Bandura.[2] First, they can provide confidence-building experiences by scaffolding student activities so they build their knowledge and skills one successful step at a time. Second, directly express the opinion that the student has the ability to succeed in the course. Third, teacher should provide evidence of peer success. Displays of successful projects, team trophies, and student awards communicate that "someone like me" can do this. Finally, ways of promoting diverse students' feelings of belonging and identity are also discussed in this session.

More than three-quarters of the survey respondents strongly agreed that the information provided in the active recruiting presentation was useful (N=195) and over 60% of the 49 respondents to the summer 2011 follow-up survey indicated that they had used the information during the prior school year.

Returning Participants

In each workshop we invite back a few teachers who attended past workshops and had success implementing the material it covered. Returning participants present their first-hand experience and are able to connect with the participants in a way that other presenters cannot. When not presenting, returning teachers are included in all of the workshop activities like any other attendee. This practice not only benefits them, but also helps create a positive environment in the workshop. Returning teachers champion our cause during informal interactions, pull from the comments of past attendees to help people in difficult circumstances, and generally streamline all aspects of the workshop. We consider the quality of our returning teachers one of our workshop series' greatest assets. Several of our repeat attendees have gone on to publish the advances they

have made[16, 20] and their attendee presentations were identified as the most valuable sessions by 97 participants in 2011 and 2012 workshops.

Many teachers in post-workshop surveys indicate a desire to attend a follow-up workshop because of the benefits they received from their participation. It was most eloquently stated by one 2012 participant: "I hope to have the opportunity to participate again. This is the most uplifting workshop I have participated in for a long time. Repeated opportunities are wonderful." Participants that we have invited multiple times confirm that repeated exposure to workshop topics offers new insights and additional room for improvement.

Student Panel

Related to the session on recruiting, we often invite a panel of female and minority computing students to speak briefly about their experiences and then field questions from the teachers. Panel discussions are typically well received – evaluations indicate over three-quarters of workshop participants who heard such panels (N=107) strongly agreed that the panels provide useful information. The panels help make the gender and recruiting topics concrete.

There is always an uncontrolled aspect to panels. Teachers ask student opinions on research the students have not encountered; students say things that are not true of most students. In general, there are moments that do not go as well as they might. Nevertheless, the majority of student panels make a positive contribution, reinforcing the principles we discuss through experiences of real students.

Inclusive and collaborative pedagogy

Many attendees express a desire to learn practices they can use for instructing their students. We next discuss such practical pedagogies in the context of how they can promote the interest and inclusion of diverse students. Because there are more pedagogical practices than can be adequately addressed in a single workshop, the practices shared in any particular workshop vary. Some of the more commonly considered practices are discussed below.

Logic groups — exercises for starting classes and developing problem-solving skills

Logic groups[16] have been a component of most Tapestry Workshops. Logic groups have students work on logic puzzles for 5-10 minutes in groups of three once every few hours of class time. A variety of practices and puzzle types are used to meet distinct learning objectives:

- Student interaction and peer learning.
- Underrepresented students can experience being in the majority within their groups to help combat stereotype threat.
- Encourage groups to think and act independently; e.g., most teacher-directed questions are answered with "I'm not part of your group," and most student solutions are evaluated for correctness by the class as a whole.

- Realization that problem solving is a creative act, through choice of problems with multiple solutions.
- Sequence problems to develop a particular logical reasoning skill; e.g., "river-crossing week" to develop deductive constraint propagation and activities that reinforce the importance of visualization by the drawing of pictures in order to obtain viable solutions.

Within the Tapestry Workshop, teachers form logic groups to solve several problems each day. After experiencing them, teachers discuss how logic groups can be applied in the classroom and why they function well for the students.

Logic group discussions have been by far the best received of all of the Tapestry Workshop presentations. Post-workshop evaluations show that more than 90% strongly agreed the logic group inclusion was very useful (N=126), 53 respondents over two years named the logic group sessions most valuable, and 63 indicated that logic groups were something that they would take back to their classrooms. In a follow-up survey with 2011 participants (N=49), more than 70% indicated they had adopted use of logic groups in their classes.

Pair Programming

Pair Programming is the practice of having two students share a single computer, trading off which one "drives" (i.e., handles the keyboard and mouse) and which one "navigates" (i.e., reviews, raises questions, and considers the big picture in conversation with the driver).[23] Pair programming is the natural extension of lab partners to computing, and has many of the same benefits as it does in other disciplines: decreased cost in teacher support, increased student productivity, increased student enjoyment, increased individual learning, and increased social skills.[19]

In addition to sharing the tips on how to train students and how to handle grading and administrative issues, we discuss pair-programming considerations applicable to diversity. For example, we discuss how the early and frequent use of pair programming can help implicitly counter stereotypes.

Analysis indicates that having attendees practice pair programming is valuable, but it should not replace instruction on pair programming mechanics.

Brainstorming and planning sessions

Another valuable element of a successful Tapestry Workshop is giving the teachers time to digest what is presented and create personal plans for recruiting, diversity, and pedagogy. Both because the workshops present a lot of information and because most high school teachers like to talk, a poorly structured brainstorming and planning meeting can result in lots of conversation but relatively little in the way of substantive implementation plans. Over time we have gravitated toward the following model for helping attendees internalize and act on workshop material:

- Encourage presenters to provide structured internalization activities within their presentations. Analysis indicates these activities work best when participants have time to come up with some ideas they will be asked to share with the rest of the attendees.
- Because high school computer science teachers rarely get to see one another, provide some unstructured time when they are all together to let them share stories and topics and generally socialize (e.g., lunches and morning ice breakers).
- Have a daily end-of-day session devoted to brainstorming and planning, and a longer session at the end of the workshop as a whole.
- In a brainstorming session, first divide attendees into small groups to talk about their impressions, thoughts and the questions raised in the preceding sessions using a generic prompt like "discuss what struck you the most in this presentation." Next have the groups group share the highlights of that discussion. Groups are then reconstituted to discuss "what can you do to improve your recruiting, diversity, and teaching?" and produce a few practical action items. Finally, each attendee is given a chance to briefly state their highest priority action item.

Active Learning

Active learning, such as CS Unplugged and Kinesthetic Learning Activities,[5, 6] are techniques for teaching computing topics without computers. These instructional practices provide an alternative perspective on computing, and may assist with recruiting diverse students.

The workshops emphasize that computing is a learned skill, not something innate. Active learning offers one more way to engage students and help them become comfortable and familiar with computing concepts.

Evaluations indicate that attendees appreciate active learning presentations for the new teaching ideas they contain. The levels of appreciation vary widely, however, based on attendee prior exposure and the energy of the presenter.

Resources Provided

Attendees receive a wealth of information and materials for informing guidance counselors, principals, parents, students, and school board members about computing, computing education and careers, and the importance of offering high quality computer science through the AP level. The materials are contributed by the National Center for Women and Information Technology (NCWIT), the Computer Science Teachers Association (CSTA), and local experts and practitioners in computer science education.

Provided materials support many aspects of workshop presentations, including best practices, case studies, and promotional fliers and posters. There are NCWIT best practice packages on CS1 and on informing school boards, principals, fellow teachers, parents, and students about the rewarding and plentiful career opportunities in computing. Three quarters of survey respondents strongly agreed that they found the materials from NCWIT and CSTA useful.

Participant recruitment, selection, and treatment

Successful recruiting of high school teacher participants relies on multiple efforts. The ACM SIGCSE, CSTA, College Board, and NCWIT maintain email lists of high-school computer science teachers and have been willing to notify their members of the workshops. Individual organizers have also had success with regional outreach. One organizer had a state board of education send announcements through the school districts to each high school. Another used postal mail to each high school in the region likely to have a CS instructor. Such efforts reach teachers who are not connected to the national email lists. One organizer had great success in reaching new applicants through other applicants. They contacted early strong applicants, told them they were accepted, and asked them to contact other teachers they knew personally.

The Workshops require all potential attendees to complete an application.[22] Besides determining applicant suitability (that they actually teach computer science, not keyboarding, etc.), the application states the expectations and commitments of all attendees. Participant selection criteria vary from workshop to workshop, depending on regional conditions. Workshop content is also somewhat adjusted to meet local needs. For example, almost none of the high schools in the surrounding region for one workshop offered AP computer science. Because few of the attendees had expertise with teaching computer science or with course content, the workshop focused on ways to initiate a computer science program. The same recruiting and diversity messages that help existing teachers improve also help new teachers begin to build a program.

Workshop organizers respect teachers for the work they do, and want them to be cognizant of that respect. The most distinctive practice communicating attendee respect is giving each attendee a $1,000 honorarium. The honorarium is intended not only to cover their travel costs but also to compensate them for their time. The National Science Foundation supplies the honorarium and determined the amount. The honorarium helps convey that we consider the attendees to be valued partners and not pupils. Another element of respect is clear communication. We make sure to communicate in detail what we will provide in housing accommodations, parking, meals, schedule, etc.

In most workshops there are a few attendees who require additional attention, either due to special dietary and mobility restrictions or simply because they are more vocal and demanding than their peers. Treating these people with courtesy and patience is key to conveying an atmosphere of respect to the entire group.

Results: Survey methodology and outcomes

At the end of each workshop, participants are asked to complete a survey about their workshop experiences and impressions. All workshop surveys include some common questions (e.g., "Overall, this workshop provided information that will help me attract more students to my CS classes") as well as questions about presentations specific to that workshop. A four-point Likert scale is used for the responses to the questions with participants choosing from among "strongly agree," "moderately agree," "moderately disagree," and "strongly disagree." Participants are also asked their sex and the number of years that they had been teaching.

In the spring following the summer workshops, participants are sent a follow-up survey to determine their use of workshop practices and materials in their teaching and their recruitment of students to their classes. Response rates are reasonable; e.g., 71% of attendees from 2011 workshops responded (N= 73).

Over two years and nine workshops, there were 224 survey respondents to the post-workshop surveys, although not all respondents answered every question. Women and men participated in nearly equal numbers and almost all participants were teachers, with a handful of principals and other administrators taking part.

Survey results show that teachers who attend our workshops are very experienced, averaging 15 years teaching with 8 years teaching computer science. Although only 13 of the 205 respondents indicated their teaching experience was five years or less, 85 had taught CS for less than 5 years and 29 of those had not yet taught a CS class prior to the workshop (they were there to learn how to create a computer science program for their schools).

Extremely high percentages (>85%) of the respondents strongly agreed that the workshop provided information that will help them attract more and more diverse students to their CS classes and that the information presented at the workshop was helpful. A somewhat lower percentage of respondents (67%) strongly agreed that the workshop provided information that would aid them persuade decision makers about the importance of their CS courses. This difference could be due to the relative lack of emphasis on persuasion as compared with recruiting and pedagogy in the workshop structure. Very high percentages of respondents indicated that the workshop compares favorably with other high school teacher workshops they have attended (87%) and that they would recommend the workshop to other high school computer science teachers (95%). Other survey results have been included in the various sections above.

Lessons Learned

Tapestry Workshops seek to improve as we incorporate experience and feedback from participants and organizers. Some lessons learned are outlined below.

Reflection

Some of less-successful attempts have included a too-guided review of the days' material, have skipped right into action items without a more general discussion, or have been too brief or too few in number. One attendee requested that we "[g]ive participants more time to interact with each other and share the[ir] knowledge and experiences. You would have more valuable and informative reflections if you gave participants time to reflect, not guided sessions on what they should reflect." Our experience agrees with this attendee's suggestion, and we have increased the time for reflection each year.

Scheduling

A temptation that any workshop organizer faces is trying to overbook each day, i.e., trying to fit in everything we think might help the teachers. These overbooked plans invariably sacrifice time from networking, reflection and comparing notes, and the brainstorming and action planning sessions. They also result in tired, less-attentive attendees.

To respect the teachers' time, workshop activities should be kept on schedule and the schedule should not include low-value activities. Scheduling practices we have found useful include:

- Include a specific "arrival" time at the beginning of each day. If the first thing on the schedule is a presentation, then some people will arrive late. If the first scheduled presentation begins later than advertised then some people will be frustrated. Having, a thirty-minute "arrival" slot on the schedule before the first presentation has largely removed these issues, particularly if light breakfast foods are available during that time.
- Have no more than two consecutive speakers without a break, and keep breaks long enough (i.e., at least fifteen minutes) to allow attendees to stretch, rest, converse, and refocus.
- Make water and a variety of refreshments available throughout the day.
- Leave meals unscheduled. Attendees want to have at least that much time to chat, compare notes, and socialize; working lunches cause them to engage in these social activities at other times, displacing scheduled activities to do so.
- Avoid scheduling important content in evening presentations. Short conversations, tours, and Q&A with industry partners go over well, but content-driven talks are best restricted to daytime sessions.
- Do not schedule long days. Intense scheduling results in weariness and prevents the networking and goal setting that helps the attendees in the long run. We found that the longest appropriate daily schedule is six hours of presentations, an hour of brainstorming, and two hours distributed between lunch and breaks.
- Ask speakers to prepare for a smaller time window than you allot them on the schedule. Beginning a presentation ahead of schedule or having some extended breaks is far preferable to feeling rushed or behind schedule.

Conclusion

We have discussed the successful and ongoing Tapestry Workshops program. Tapestry Workshops have been offered by eight institutions in the past two years and build on three additional years of experience at University of Virginia. They have been rated highly by the vast majority of participants. The workshops are designed to inform high school educators how to increase the number and diversity of computer science students. Presentations are based on research-backed results and cover a variety of recruiting and classroom practices designed to reduce the impact of negative stereotypes and help with successful student outcomes. Past participants report they have implemented practices suggested in the workshops and that doing so has increased their enrollment and the diversity of their classrooms.

The Tapestry Workshops program has demonstrated that a large benefit may be gained from the relatively small investment of a three-day workshop. High school computer science teachers are eager to learn how best to attract and retain more and more diverse students. By giving them the knowledge and tools to do so effectively, the field of computing has gained many enthusiastic, qualified, and diverse participants. We look forward to continuing to spread these messages to more teachers and to further train and encourage those we have already assisted.

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