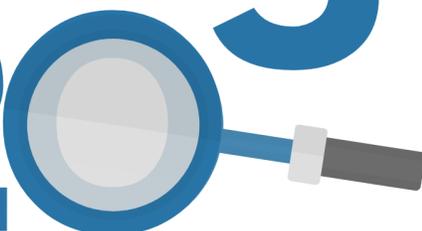


# Teacher Computer Science Professional Development Evaluation Toolkit

A Companion Document to the Guidebook for  
Virtual Professional Development for Computer Science Teachers

# Hindsight 2020



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## Foreword

The Teacher Computer Science (CS) Professional Development (PD) Evaluation Toolkit has been created based on several conversations with multiple PD providers between Fall 2020 and Spring 2021. In an effort to improve their PD, the PD providers, who worked locally, regionally, and nationally, stated a need for assistance in evaluating their PD. Based on our discussions, we hypothesized that this need stemmed from the rapid development of PD across the U.S. (and world), limited resources for PD, and/or limited time due to the shift from in-person to virtual during the pandemic.

Regardless of the reasons, as part of a National Science Foundation (NSF) grant awarded to investigate how PD providers changed their offerings due to the pandemic, we first created the [Guidebook for Virtual Professional Development for Computer Science Teachers: Lessons Learned from Summer 2020](#). We then took our knowledge gained from our study, combined these with the expressed evaluation needs from the PD providers, and produced this toolkit that could potentially be used as a “plug and play” tool for PD evaluation.

This toolkit provides tips and specific ways PD providers can put together a pre- and/or post-survey for PD participants to inform improvements to the PD. As a toolkit, this doesn’t mean we suggest PD providers ask every single question that we provide. Rather, we hope that providers can reflect on what *their* goals are for a specific PD that they offer, then select questions and items that reflect the growth areas in which they want to focus.

As more and more states and regions implement CS education for their students, the ability to build capacity through teacher professional development is more important than ever. CS PD is expected to grow rapidly over the next few years. Our hope is that this toolkit will be helpful to those who might need it.

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## Introduction

In this toolkit, we provide a guide for Computer Science (CS) K-12 teacher Professional Development (PD) providers for evaluating their professional development offerings based on the impact on their participants. Evaluating your PD can help you determine in which ways your PD is (and is not) meeting its goals by providing you with specific, targeted data to inform changes to your PD. This formative feedback can be improved and additional goals can be met in the future.

This toolkit is based on a Continuous Improvement model promoted by organizations like the Carnegie Foundation for the Advancement of Teaching (Carnegie Foundation for the Advancement of Teaching, 2021). The foundation posits six core principles for the continuous improvement model:

1. **Make the work problem-specific and user-centered.** This starts with a single question: “What specifically is the problem we are trying to solve?” This question enlivens a co-development orientation through engagement of key participants, particularly if this question is posed early and often.
2. **Variation in performance is the core problem to address.** The critical issue is not what works, but rather *what works, for whom and under what set of conditions*. Your aim through this process is to advance *efficacy* reliably at scale.
3. **See the system that produces the current outcomes.** It is hard to improve that which you do not fully understand. Observe how local conditions shape your PD processes and offerings. Make your hypotheses for change public and clear.
4. **We cannot improve at scale what we cannot measure.** Embed measures of key outcomes and processes to track if change is an improvement. Work to anticipate unintended consequences and measure these as well.
5. **Anchor practice improvement in disciplined inquiry.** Engage rapid cycles of Plan, Do, Study, Act (PDSA) to learn fast, fail fast, and improve quickly. That failures may occur is not the problem; that we fail to learn from them is.
6. **Accelerate improvements through networked communities.** Embrace the wisdom of crowds. We can accomplish more together than even the best of us can accomplish alone.

The PDSA model is defined as “...a systematic process for gaining valuable learning and knowledge for the continual improvement of a product, process, or service. Also known as the Deming Wheel, or Deming Cycle, this integrated learning - improvement model was first introduced to Dr. Deming by his mentor, Walter Shewhart of the famous Bell Laboratories in New York” (Deming Institute, undated). In the context of CS Teacher PD, we adapted the four steps of the PDSA method as follows:

**Plan:** Determine the learning goals of your PD. Design and develop your PD. Determine the measures you will need to determine whether those goals are met and when you will collect data for those measures.

**Do:** Offer your PD to teachers and use the measurement methods and tools at the appropriate times.

**Study:** Analyze the results from the measures implemented.

**Act:** Modify your PD based on the results from your Study.

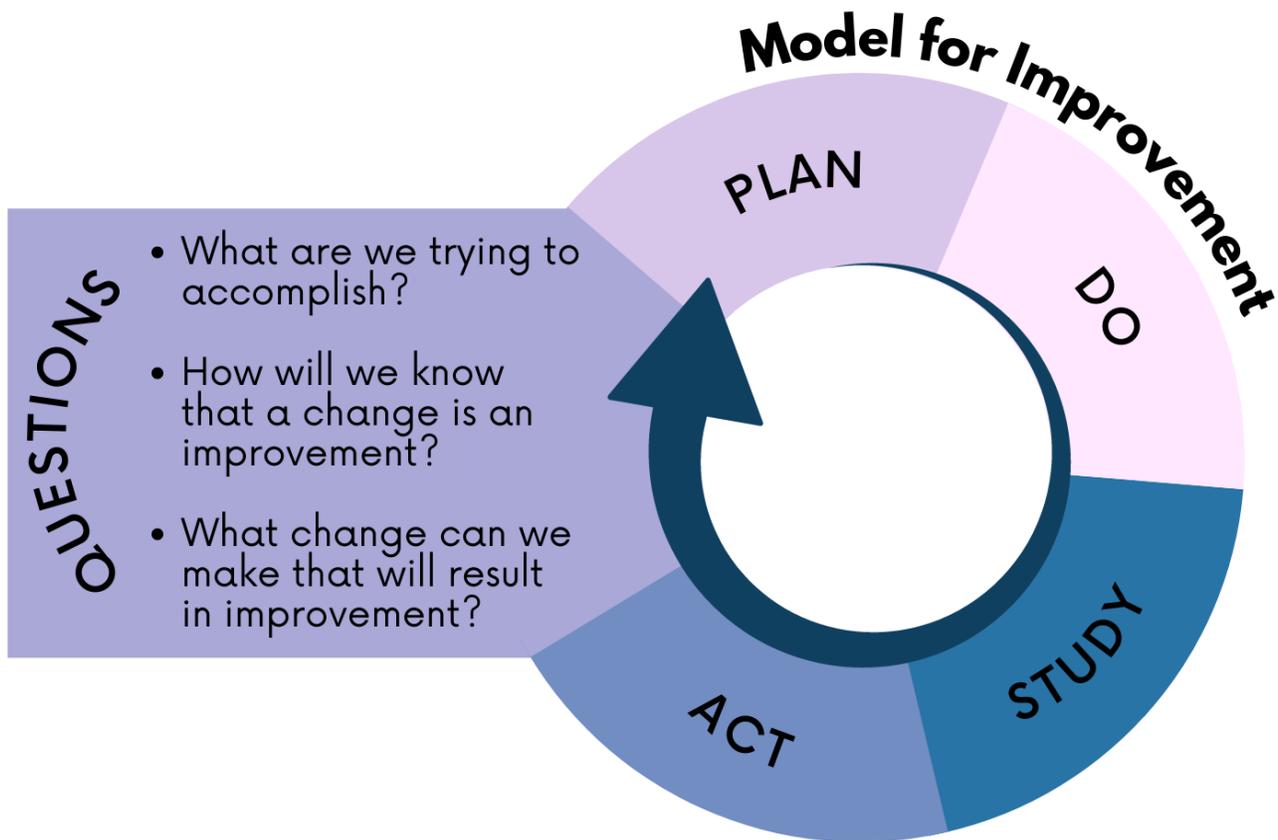


Figure 1. Adapted from the [PDSA model](#) for continuous improvement.

## Culturally Relevant Pedagogy

The resources provided in this toolkit are grounded Gloria Ladson-Billings (1995) work in Culturally Relevant Pedagogy, which focuses on increasing engagement and academic success of students from diverse cultures who have historically been excluded. Culturally relevant pedagogy aims to support all students in developing positive cultural and academic identities while calling attention to the pervasive inequities and inequalities in education. By designing and implementing PD or lessons through an equity-lens based in the foundational theory of culturally relevant pedagogy, students (adults or children) are able to “uphold their cultural identities” (California Department of Education, 2020), while also supporting critical consciousness to recognize societal inequities that impact education. This is particularly important with respect to CS education, due to its historical marginalization of girls, BIPOC+

(Black, Indigenous, People of Color) students, students attending schools that are designated as Title I, students with disabilities, and more (Leonard, Thomas, Ellington, Mitchell, & Fashola, 2022). Therefore, our suggested tools and instruments are designed to be equity-focused to understand the impact of the PD offering (e.g., learning environment, pedagogy, curriculum) on the whole participant.

Many teachers who participate in Computer Science (CS) Professional Development (PD) are experienced math, science, or business teachers (Zarch & Peterfreund, 2017) and are therefore learning both new content and a new pedagogy. Findings from the 2018 National Survey of Science and Math Educators (Banilower, 2019), which included CS for the first time, suggest that there is an urgent and unique need for PD for CS teachers due the fact that only about 1 in 4 high school CS teachers have not had PD opportunities in the last 3 years, reflecting the novelty of the field. Likewise, CS is the subject least likely to have locally available PD or ongoing support. Up to half of schools do not offer any CS PD, increasing the need for regional or national CS programs. Additionally, many CS teachers are in a new content area and are novice CS teachers, making the PD critical for building the capacity to offer adequate CS instruction.

## How to Use this Toolkit

To use this toolkit effectively depends on the resources your organization has committed to evaluating your PD and the expertise of your team. As with any evaluation, time is needed to collect and analyze the data and to review the results in a manner that brings about improvements in your PD. Although it is likely that your team may be able to engage in a trial-and-error approach to improving your PD offerings over time, a carefully curated evaluation plan can improve the effectiveness and efficacy of your PD in less time. The trade-off of committing resources now to a smart and focused evaluation plan will outweigh the time involved in developing a trial-and-error cycle over multiple PD sessions.

We recommend that, if you have the time, read through each section of this toolkit. However, if your time is limited, we recommend that you read the Plan section, determine which components of your PD that are important for you to evaluate, then choose the items and constructs in the Appendix that you may want to use. When it's time to analyze the data you have collected, refer to the "Study" section of this document for guidance on how to analyze and interpret your findings.

To collect **all** data suggested in this toolkit is impractical. A survey of that length will be too long for participants to take and complete.

Instead, we suggest that you consider what is most important for **your** particular PD offering and in which areas you want your participants to grow, then measure those.

## Plan

Planning your PD first requires the important task of determining the professional development goals of your PD offering. Key questions for your team to answer before planning evaluation include (McGill et al, 2020; McGill et al, 2021):

What are the values of the district and school communities in which participants belong?	Local PD providers may be fully aware of the <b>values</b> that are important for consideration in developing their PD. Regional, state, and national PD providers may need to understand that these values may differ across the schools and districts from which their teacher participants come. We recommend that PD providers incorporate these generalized values into the evaluation measures.
What are factors that impact student learning that are most important to the participants?	We recommend that you are aware of what participants attending your PD are most interested in learning.
What key data points are needed to improve CS PD offerings?	We recommend that you consider which key data points are needed to improve your offerings.
What constructs around equity should be measured to better understand if the CS PD affects teachers' beliefs about each student's ability to learn CS?	Regardless of school location, district, or state in which the participants are from, teacher mindsets toward ensuring all students are seen as able to succeed in learning CS.
What other data that might impact student learning should be collected?	Understanding the impacts teachers have on student learning can ensure that the most essential data is collected.

Once you/your team has established these goals, you can then determine 1) the measures and the data you will need to understand whether those goals were met and 2) when you will collect data for those measures. In this section, we discuss the goals and the types of data that will be collected. We discuss when to collect the data in the next section.

### Demographic Data

Based on our experience in the field and with CS PD, we encourage CS PD providers to collect meaningful data that is inclusive (e.g., disabilities of participants and their unique needs) and will lead to an improved experience for participants by directly meeting their needs.

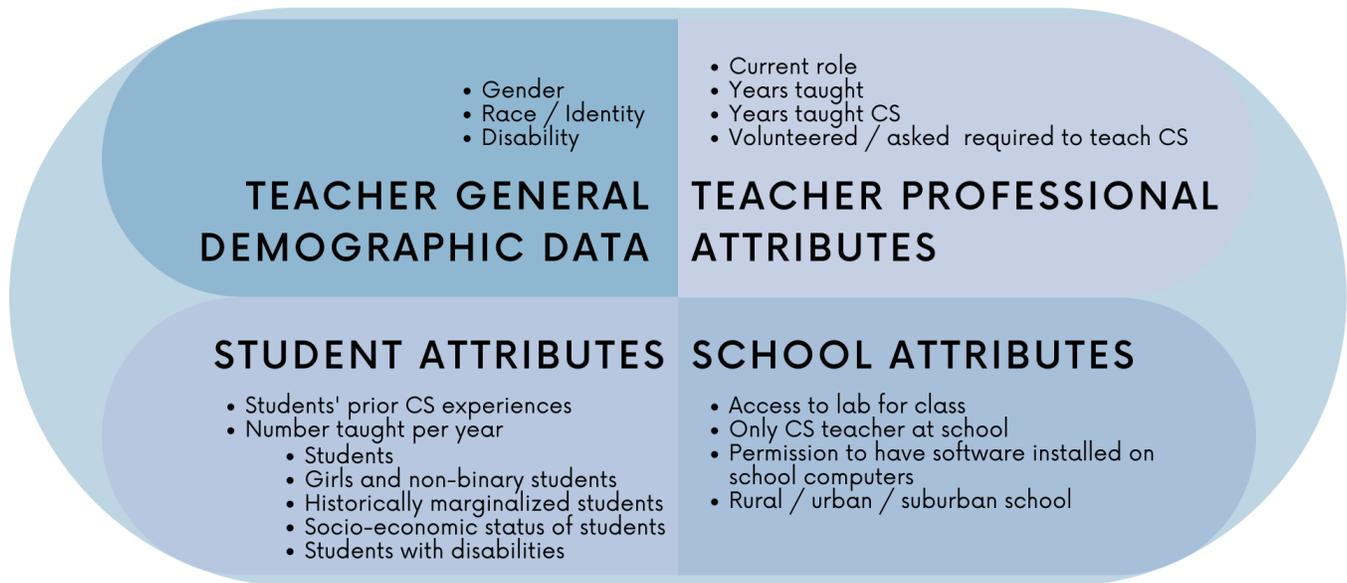


Figure 2. Recommendations for demographic data collection to learn more about the teachers participating in your PD and the environments in which they teach.

### Participant General Demography

We recommend that CS PD providers collect participants’ gender, race/ethnicity, and disability. Participant demographics provide insight for how to meet the needs of each participant, including those from historically underrepresented groups, during PD. This data helps ensure that sufficient data is collected to help determine if teachers in general have equitable access to the CS PD. Though disability is often overlooked, we call this out as necessary data to ensure the CS PD meets participants’ needs. Table 1 contains recommendations for data to collect regarding general demographic data.

We also recommend providing a statement that describes why demographic information is being collected and how it will be used. An example statement is provided below:

A major goal of our PD is to increase the number of students who have access to, participate in, and positively experience CS education. This includes students who have traditionally been excluded from CS and CS education, including, but not limited to, students with disabilities, girls and nonbinary students, and students of Black, Indigenous, and Hispanic descent.

We ask for certain demographic information from all PD participants, since this data allows us to know our “audience”, be respectful to your preferred pronouns and helps us remain aware of the many differences of identity and experiences represented in teacher and student populations. It may also help us understand possible differential impacts of the PD and where we may need to change it to be more inclusive and equitable.

As a reminder, your individual data will only be shared with the PD development team. [To be optionally added for those who might publish results: If publications should result from this work, only aggregated data will be used in a way that follows best practices and protects responses in which the number of participants responding to a question is less than 10.]

We thank you in advance for sharing this information with us.

<b>Gender</b>	<p>What is the gender you most closely identify?</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <input type="radio"/> Cisgender Female  <input type="radio"/> Cisgender Male  <input type="radio"/> Transgender Female  <input type="radio"/> Transgender Male         </div> <div style="width: 45%;"> <input type="radio"/> Non-Binary  <input type="radio"/> Other [please describe]  <input type="radio"/> Prefer not to say         </div> </div>
<b>Pronouns</b>	<p>Which pronouns do you prefer to use? <i>*Can choose more than one</i></p> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <input type="checkbox"/> He/Him  <input type="checkbox"/> She/Her  <input type="checkbox"/> They/Them         </div> <div style="width: 45%;"> <input type="checkbox"/> Other pronouns [please describe]  <input type="checkbox"/> Prefer not to say         </div> </div>
<b>Race/Ethnicity</b>	<p>What is your race/ethnicity? <i>*Can choose more than one</i></p> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <input type="checkbox"/> Asian American and Pacific Islander  <input type="checkbox"/> Black/African Descent  <input type="checkbox"/> Central Asian  <input type="checkbox"/> East Asian  <input type="checkbox"/> Hawaiian Aboriginal Descent  <input type="checkbox"/> Indigenous (Guam)  <input type="checkbox"/> Indigenous (Native to America)  <input type="checkbox"/> Indigenous (Native to Alaska)  <input type="checkbox"/> Indigenous (Polynesian)         </div> <div style="width: 45%;"> <input type="checkbox"/> Indigous Pacific Islander  <input type="checkbox"/> Latino/a/e  <input type="checkbox"/> Middle Eastern/North African  <input type="checkbox"/> South Asian  <input type="checkbox"/> Southeast Asian  <input type="checkbox"/> White/ European Descent  <input type="checkbox"/> Other pronouns [please describe]  <input type="checkbox"/> Prefer not to say         </div> </div>
<b>Disability Status</b>	<p>Do you have a long-lasting or chronic condition (such as physical, visual, auditory, cognitive, emotional or other) that requires ongoing accommodations for you to conduct daily life activities (such as your ability to see, hear or speak; to learn, remember or concentrate)?</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <input type="radio"/> Yes  <input type="radio"/> No  <input type="radio"/> Prefer not to answer         </div> <div style="width: 45%;"> <p>If Yes: What accommodations, if any, do you need to be fully engaged in the PD?</p> </div> </div>

Table 1. Recommendations for Teacher Demographics Data to Collect. *'Gender and Pronouns are summarized from the [The Safe Zone Project](#)' (The Safe Zone Project, 2021).*

### Participant Professional Attributes

We recommend CS PD providers collect participants' current role, years taught, and years teaching CS as important aspects of framing the experience. Developing a wider understanding of the teacher attributes provides insight into the experience and engagement with CS education on a professional level, as well as at a school or district level. This includes asking participants whether they volunteered or were required to teach CS, which can provide insight into a participant's perspective of their PD experience. If the participant is the sole CS teacher in their school or district, this provides context for understanding issues related to community, resources, and support for the participant.

The other attributes appearing in Table 2 may be valuable to add based on the focus or objectives of the CS PD.

<b>Current Role</b>	<i>*PD provider: Depending on your needs, you may choose to ask specific grade levels currently taught. *Can choose more than one</i>	
	<input type="checkbox"/> Early Childhood Teacher (PK-2) <input type="checkbox"/> Primary Teacher(3-5) <input type="checkbox"/> Middle Teacher (6-8) <input type="checkbox"/> Secondary Teacher (9-12)	<input type="checkbox"/> Teacher- Leader or Instructional Coach <input type="checkbox"/> School Level Administrator <input type="checkbox"/> District Level Administrator <input type="checkbox"/> Other (please specify)
<b>Years Taught</b>	<input type="radio"/> I have not yet taught <input type="radio"/> 1 year (this is my first year) <input type="radio"/> 2-3 years <input type="radio"/> 4-5 years	<input type="radio"/> 5-10 years <input type="radio"/> 11-15 years <input type="radio"/> 16-25 years <input type="radio"/> More than 25 yrs
<b>Years Taught CS</b>	<input type="radio"/> I have not yet taught (CS) <input type="radio"/> 1 year (this is my first year) <input type="radio"/> 2-3 years <input type="radio"/> 4-5 years	<input type="radio"/> 5-10 years <input type="radio"/> 11-15 years <input type="radio"/> 16-25 years <input type="radio"/> More than 25 yrs
<b>Teaching CS Assignment</b>	How did you gain your opportunity to teach CS?	<input type="radio"/> Volunteered <input type="radio"/> Assigned with choice <input type="radio"/> Required with no choice
<b>Certification and Subjects Taught</b>	What are your areas of certification? ( <i>open ended or PD providers can add known certifications for their region</i> )  What subjects do you teach? <i>*Can choose more than one</i>	
	<input type="checkbox"/> Across all subjects (e.g., primary school teacher) <input type="checkbox"/> Arts / Music <input type="checkbox"/> Computer Science <input type="checkbox"/> History / Social Studies	<input type="checkbox"/> Language Arts <input type="checkbox"/> Mathematics <input type="checkbox"/> Physical Education <input type="checkbox"/> Sciences <input type="checkbox"/> Other (please specify)
<b>How CS/CT is Taught</b>	<input type="radio"/> As a stand-alone subject	<input type="radio"/> Integrated into other subjects
<b>Teacher Connectedness</b>	How connected do you feel to other teachers who teach CS? <input type="radio"/> Highly connected <input type="radio"/> Moderately connected <input type="radio"/> Somewhat connected	
	<input type="radio"/> Slightly connected <input type="radio"/> Not connected at all	

Table 2. Recommendations for Teacher Professional Attributes to Collect

## School Attributes

We recommend collecting data about the attributes for the school(s) in which participants teach. This provides the ability for PD providers and facilitators to have an understanding of the contexts in which participants teach. We recommend collecting data about participants' access to a teaching lab or other questions related to their teaching environment, as well as their school's ability to install software on computers for teaching CS. Responses to these questions may affect the software the schools/participants choose to use to teach CS.

Collecting information regarding the school that participants are working in provides the PD provider a more holistic understanding of the school and district CS environment.

Technology Access	Software Permissions	Title I School	Location <sup>1</sup>
<p>Do you have access to Assistive Technologies to support students with disabilities through your school or district?</p> <p><input type="radio"/> Yes <input type="radio"/> No</p> <p>Do you have access to Assistive Technologies to support emergent language learners?</p> <p><input type="radio"/> Yes <input type="radio"/> No</p> <p>Do students have access to a computer lab or computer?</p> <p><input type="radio"/> Yes, access to a computer lab for instruction. <input type="radio"/> No access to a computer lab or computers</p> <p><input type="radio"/> Yes, 1:1 student device access</p>	<p>What type of software permissions does your school/district have?</p> <p><input type="radio"/> Permission to have software installed on school computers</p> <p><input type="radio"/> Permission to install software on school computers through exemptions only (i.e. connected to an approved curricula or direct education purposes)</p> <p><input type="radio"/> No permissions to have software installed on school computers</p>	<p>Is your school a Title I school?</p> <p><input type="radio"/> Yes, school is identified as a Title I School</p> <p><input type="radio"/> No, school is not identified as a Title I School</p>	<p>What type of location is your school located in?</p> <p><input type="radio"/> City</p> <p><input type="radio"/> Rural</p> <p><input type="radio"/> Town</p> <p><input type="radio"/> Suburban</p>

Table 3. Recommendations for School Attributes to Collect

### Student Attributes

Combined with the other information, knowing the attributes of the students the PD participants teach will add one more piece of data to evaluate when planning or redesigning your PD. Asking participants about student attributes can be instrumental in understanding the composition of the participants’ classrooms and unique challenges participants may face in creating an equitable environment for learning CS.

Asking teachers to *estimate* their students’ proficiency or previous experiences with CS can help PD providers understand what pedagogical content to include. Prompting teachers to reflect on their students’ proficiency and potential knowledge & skill needs may assist teachers in scaffolding their engagement with the PD.

Understanding other student attributes, such as their demographic information and assets and characteristics of the local community(ies) in which the students are located, introduces the opportunity to talk about culturally responsive teaching approaches, social impacts of computing, historical patterns of racism in computing and education & their modern legacies.

We do *not* recommend asking a teacher to *estimate* their students’ demographics regarding gender (including non-binary or gender fluid), disability status, race/ethnicity, and socioeconomic status as this has the potential of being influenced by personal assumptions and biases held by the teachers. We recognize that district data itself is imperfect and does not always reflect students’ actual identities or the range of possible identities due to multiple and intersecting historical patterns of oppression and marginalization.

<sup>1</sup> <https://nces.ed.gov/surveys/ruraled/definitions.asp>

<b># of Students Taught Per Year</b>	How many students do you teach per year?		
	<input type="radio"/> 0-20 students	<input type="radio"/> 21-50 students	<input type="radio"/> 51-100 students <input type="radio"/> More than 100 students
<b>Gender Demographics of Students (%)</b>	What are the gender demographics of your students by percentage? <i>*Information based on student reported data to the district.</i>		
	<input type="checkbox"/> Cisgender Female <input type="checkbox"/> Cisgender Male <input type="checkbox"/> Non-Binary	<input type="checkbox"/> Transgender Female <input type="checkbox"/> Transgender Male <input type="checkbox"/> Another Gender	
<b>BIPOC+ Students Taught Per Year (%)</b>	What are the race/ethnicity demographics of your students by percentage? <i>*Information based on student reported data to the district.</i>		
	<input type="checkbox"/> Asian American and Pacific Islander <input type="checkbox"/> Black/African Descent <input type="checkbox"/> Central Asian <input type="checkbox"/> East Asian <input type="checkbox"/> Hawaiian Aboriginal Descent	<input type="checkbox"/> Indigenous (Guam) <input type="checkbox"/> Indigenous (Native to America) <input type="checkbox"/> Indigenous (Native to Alaska) <input type="checkbox"/> Indigenous (Polynesian) <input type="checkbox"/> Indigenous Pacific Islander	<input type="checkbox"/> Latino/a/e <input type="checkbox"/> Middle Eastern/North African <input type="checkbox"/> South Asian <input type="checkbox"/> Southeast Asian <input type="checkbox"/> White/ European Descent <input type="checkbox"/> Other pronouns [please describe]
<b>Students Identified with a Disability Taught Per Year (%)</b>	What is the percentage of your students with IEPs/504s?		
	<input type="checkbox"/> Percentage of students with an identified (IEP or 504) disability		
<b>Students Identified as ELL Taught Per Year (%)</b>	What is the percentage of your students who are emerging bi/multilingual (ELL)?		
	<input type="checkbox"/> Percentage of students identified as emerging bi/multilingual (ELL)		

Table 4. Recommendations for Student Attributes to Collect

## Program Satisfaction

What CS PD providers collect with respect to program satisfaction varies across providers. It seems reasonable that providers want to collect information about their logistics (e.g., registration, communications, etc.), and we found that approximately two-thirds of providers do (McGill, et al, 2021). When program satisfaction data is gathered, it can provide a wider lens of the overall impact of the PD on CS teachers’ novice to expert journey (Benner, 1982; Dreyfus, 2004).

In this section, we offer a set of recommendations for collecting information related to CS PD programming satisfaction as a standard practice.

### Logistics

We recommend that providers consider logistics related to processes (e.g., recruiting, communications to participants, ease in registering) that are suitable for learning how to improve the process. For in-person PD offerings, we recommend collecting information about travel and the accommodations.

Recruitment	Communication	Registration
How did you learn about this professional development? <input type="radio"/> Email <input type="radio"/> Friend <input type="radio"/> Colleague <input type="radio"/> Social media <input type="radio"/> Professional Learning Network (PLN) <input type="radio"/> Other (Please specify)	How clear was the communication leading up to the planned professional development? <input type="radio"/> Highly clear <input type="radio"/> Moderately clear <input type="radio"/> Somewhat clear <input type="radio"/> Slightly clear <input type="radio"/> Not clear at all <input type="radio"/> There was no communication between registration and professional development.	How easy was the process of registering for the PD? <input type="radio"/> Very easy <input type="radio"/> Moderately easy <input type="radio"/> Somewhat easy <input type="radio"/> Slightly easy <input type="radio"/> Not easy at all

Table 5. Logistics questions that can be asked when collecting data about teachers' satisfaction with the program.

### Learning Environment

Like in-person environments, virtual environments can positively or negatively impact learning. When offering virtual PD, it can be expected that outside pressures may influence learning (e.g., care-taking responsibilities, Internet access, hardware needed for the course). We recommend that questions be asked to ascertain participants' learning environments. Depending on your needs, you could ask more detailed questions about facilitator effectiveness (e.g., knowledge, engagement, and delivery).

Learning Environment	Learning Environment	Facilitator
What outside factors, if any, enabled or enhanced your full participation in this PD: <input type="radio"/> Accessibility of materials and content ( e.g., closed captioning, interpreter, handouts provided) <input type="radio"/> Collaborative breakout room <input type="radio"/> Environmental (e.g., temperature, noise levels) <input type="radio"/> Internet Accessibility <input type="radio"/> Peer/table partners <input type="radio"/> Other (please specify): <input type="radio"/> None	What outside factors, if any, prevented your full participation in this PD: <input type="radio"/> Accessibility of materials and content ( e.g., closed captioning, interpreter, handouts provided) <input type="radio"/> Collaborative breakout room <input type="radio"/> Environmental (e.g., temperature, noise levels) <input type="radio"/> Internet Accessibility <input type="radio"/> Peer/table partners <input type="radio"/> Other (please specify): <input type="radio"/> None	How effective was your facilitator? <input type="radio"/> Highly effective <input type="radio"/> Moderately effective <input type="radio"/> Somewhat effective <input type="radio"/> Slightly effective <input type="radio"/> Not effective at all

Table 6. Questions about the learning environment that can be asked when collecting data about teachers' satisfaction with the program.

### Course Engagement

Engagement is an important aspect of learning, and there may be other measures that can provide clues as to the level of engagement by participants (e.g., observation, sidebar conversations). However, asking participants what their perceived level of engagement was during the PD offering is also acceptable. We recommend asking a couple of questions related to course engagement.

PD engagement	Collaboration with Peers
How engaging was the PD? <input type="radio"/> Highly engaging <input type="radio"/> Moderately engaging <input type="radio"/> Somewhat engaging <input type="radio"/> Slightly engaging <input type="radio"/> Not engaging at all	How was the balance of collaboration to working independently throughout the PD? <input type="radio"/> Far too much collaboration <input type="radio"/> Slightly too much collaboration <input type="radio"/> Just the right balance of collaboration and independent work <input type="radio"/> Slightly too much independent work <input type="radio"/> Far too much independent work

Table 7. Course engagement questions that can be asked when collecting data about teachers' satisfaction with the program.

### Course Pace

In-person and virtual course offerings have their own pace, which is an important aspect of learning. We recommend asking participants for their perceptions of the course pace. This will provide valuable data for future CS PD implementation.

Time Use during PD	Course Pace
How would you describe the PD time used? <input type="radio"/> Highly efficient <input type="radio"/> Moderately efficient <input type="radio"/> Somewhat efficient <input type="radio"/> A little efficient <input type="radio"/> Not efficient at all	How would you describe the course pace? <input type="radio"/> Too fast <input type="radio"/> Fast <input type="radio"/> Just right <input type="radio"/> Slow <input type="radio"/> Too slow

Table 8. Questions about the pace of the PD that can be asked when collecting data about teachers' satisfaction with the program.

### Content, Pedagogy, and Technological Knowledge

This toolkit includes questions designed to understand teachers' *self-reported* knowledge gains in three areas--content knowledge, pedagogical content knowledge, and technological content knowledge. Assessing knowledge can be challenging and would substantially increase the time it takes for participants to complete the survey; however, it may be what you need to support your PD evaluation goals. To learn more about assessing TPaCK beyond self-reports see <https://matt-koehler.com/tpack2/assessing-teachers-tpack/>.

The questions are based on the TPACK Framework and include content knowledge, pedagogical content knowledge, and technological knowledge separately and where they interconnect (Mishra & Koehler, 2006). The definition of the three areas of TPACK are:

- **Content Knowledge:** What is the participant’s knowledge of the subject?
- **Pedagogical Knowledge:** What strategies do participants need to use to instruct their students effectively?
- **Technological Knowledge:** What digital tools are available to participants and that participants know well enough to use?

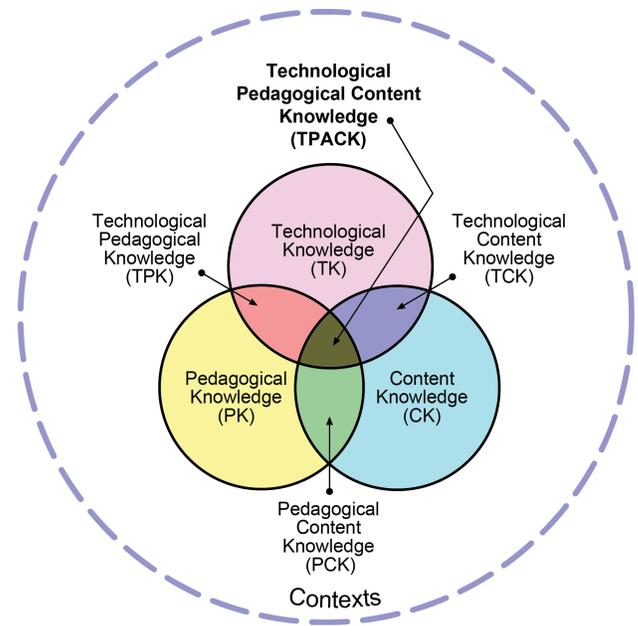


Figure 3. TPACK Framework. Reproduced by permission of the publisher, © 2012 by tpack.org. ([www.tpack.org](http://www.tpack.org))

### Content Knowledge (CK)

CK Prior to PD	CK Post-PD	Increase in CK in <PD topic>
How much knowledge did you have about <PD topic> before taking this PD? <input type="radio"/> This is brand new <input type="radio"/> I am aware of it. <input type="radio"/> I understand it. <input type="radio"/> I can apply it. <input type="radio"/> I can teach others.	How much knowledge do you have about <PD topic> now? <input type="radio"/> This is brand new <input type="radio"/> I am aware of it. <input type="radio"/> I understand it. <input type="radio"/> I can apply it. <input type="radio"/> I can teach others.	How much has your content knowledge about <PD topic> increased? <input type="radio"/> Highly increased <input type="radio"/> Moderately increased <input type="radio"/> Somewhat increased <input type="radio"/> Slightly increased <input type="radio"/> Did not increase at all

Table 9. Self-reported Content Knowledge questions for understanding how well teachers’ perceive their learning from the PD.

### Pedagogical Content Knowledge (PCK)

PCK Prior to PD	PCK Post-PD	Increase in PCK in <PD topic>
How much pedagogical content knowledge did you have about teaching <PD topic> before taking this PD? <input type="radio"/> This is brand new <input type="radio"/> I am aware of it. <input type="radio"/> I understand it. <input type="radio"/> I can apply it. <input type="radio"/> I can teach others.	How much pedagogical content knowledge do you have about teaching <PD topic> now? <input type="radio"/> This is brand new <input type="radio"/> I am aware of it. <input type="radio"/> I understand it. <input type="radio"/> I can apply it. <input type="radio"/> I can teach others.	How much was your pedagogical content knowledge about <PD topic> increased? <input type="radio"/> Highly increased <input type="radio"/> Moderately increased <input type="radio"/> Somewhat increased <input type="radio"/> Slightly increased <input type="radio"/> Did not increase at all

Table 10. Self-reported Pedagogical Content Knowledge questions for understanding how well teachers’ perceive their learning from the PD.

## Technological Knowledge (TK)

TK Prior to PD	TK Post-PD	Increase in TK in <PD topic>
<p>How much knowledge did you have about teaching with &lt;digital tools for teaching PD&gt; before taking this PD?</p> <p><input type="radio"/> This is brand new</p> <p><input type="radio"/> I am aware of it.</p> <p><input type="radio"/> I understand it.</p> <p><input type="radio"/> I can apply it.</p> <p><input type="radio"/> I can teach others.</p>	<p>How much knowledge do you have about teaching with &lt;digital tools for teaching PD&gt; now?</p> <p><input type="radio"/> This is brand new</p> <p><input type="radio"/> I am aware of it.</p> <p><input type="radio"/> I understand it.</p> <p><input type="radio"/> I can apply it.</p> <p><input type="radio"/> I can teach others.</p>	<p>How much has your knowledge about teaching with &lt;digital tools for teaching PD&gt; increased ?</p> <p><input type="radio"/> Highly increased</p> <p><input type="radio"/> Moderately Increased</p> <p><input type="radio"/> Somewhat increased</p> <p><input type="radio"/> Slightly increased</p> <p><input type="radio"/> Did not increase at all</p>

Table 9. Self-reported Technological Content Knowledge questions for understanding how well teachers' perceive their learning from the PD.

## Beliefs

### Equity

Research has indicated that teacher beliefs regarding equity, specifically students' ability to learn a specific topic, is directly related to student academic outcomes. Equity mindset "...refers to the perspective or mode of thinking exhibited by practitioners who call attention to patterns of inequity in student outcomes. These practitioners are willing to take personal and institutional responsibility for the success of their students, and critically reassess their own practices." (University of Southern California - Center for Urban Education, 2021) This mindset requires practitioners to understand that each student has the capacity to learn, regardless of their personal characteristics, upbringing, family's economic status, and more.

The impact of teacher beliefs on students' actual demonstrated knowledge is known as stereotype threat. A stereotype threat is a "socially premised psychological threat that arises when one is in a situation or doing something for which a negative stereotype about one's group applies" (Steele, 1997, p. 617). In other words, "teachers' belief in their students' academic skills and potential is a 'vital ingredient for student success' because it is linked to the students' beliefs about 'how far they will progress in school, their attitudes toward school, and their academic achievement'" (The Graide Network, 2018, para. 10). Educators' beliefs are critical to developing inclusive and equitable classroom environments. Therefore, we recommend surveying teachers' beliefs related to equity.

Question	Likert Scale
How confident are you that <i>all</i> students can learn <PD topic>?	<p>Likert scale for each item:</p> <p><input type="radio"/> Highly confident</p> <p><input type="radio"/> Moderately confident</p> <p><input type="radio"/> Somewhat confident</p> <p><input type="radio"/> Slightly confident</p> <p><input type="radio"/> Not at all confident</p>
How confident are you that all of <i>your</i> students can learn <PD topic>?	

Table 10. Questions for understanding teachers' equity-mindset.

### Self-Efficacy

Teacher self-efficacy has been shown to be an important factor in students learning in general (Bal-Taştan, 2018; Khourey-Bowers & Simonis, 2004; Shahzad & Naureen, 2017; Zee & Koomen, 2016) and in CS education in particular (Vivian & Falkner, 2018; Yadav, Lishinski, & Sands, 2021). Given its importance in student learning, it is

important to gauge the impact (positive or negative) of the PD on teachers’ self-efficacy of the topic(s) being covered in the PD offering.

Questions	Likert Scale
How confident are you that you can help your students learn <PD topic>?	<i>Likert scale for each item:</i> <input type="radio"/> Highly confident <input type="radio"/> Moderately confident <input type="radio"/> Somewhat confident <input type="radio"/> Slightly confident <input type="radio"/> Not at all confident
How thoroughly do you feel that you know all the <PD topic> content you need to teach?	
How clearly can you explain the most complicated material about <PD topic> to your students?	
Thinking about growth mindset in particular, how confident are you that you can support your students’ growth and development in <PD topic>?	
Thinking about self-efficacy in particular, how confident are you that you can support your students’ growth and development in <PD topic>?	

Table 11. Questions for understanding teachers’ self-efficacy. Questions are adapted from Panorama Education User Guide Panorama Teacher and Staff Survey (Panorama Education, 2018).

### Interest in Teaching CS

It has been previously shown that teachers’ interest in teaching a subject can impact student academic achievement (Kaya, et al, 2019). Regardless if an educator volunteers or is assigned to teach CS or computational thinking, their interest in teaching will provide the PD provider a context of mindsets and beliefs among the participants. The survey questions in “interest” focus on the personal and professional interest of educators in the context of teaching CS and are adapted from the Motivation to Teach Computer Science instrument (Martin, et al, 2021a; Martin, et al, 2021b).

**I am interested in teaching <PD topic> because...**

... I thought it would be satisfying.	<i>Response options for each item:</i> <input type="radio"/> Definitely true <input type="radio"/> Moderately true <input type="radio"/> Somewhat true <input type="radio"/> Slightly true <input type="radio"/> Not true at all
... I love learning new things.	
... I thought it would be fun to learn CS skills/concepts.	
... it would provide me with great job security as a teacher.	
... it had more prestige than teaching other subjects.	
... I felt pressure from my district to teach CS (administration or others).	

Table 12. Interest in teaching. Adapted the Motivation to Teacher Computer Science (MTCS) Scale (Martin, et al, 2021a; Martin, et al, 2021b).

### Perspectives on Relevance of CS

Regardless if an educator is volunteered or assigned to teach CS, their perspective on the relevance of CS will provide the PD provider a context of mindsets and beliefs among the participants. The survey questions in “relevance” focus on the relevance of CS in the future lives of educators’ students and are adapted from the Motivation to Teach Computer Science instrument (Martin, et al, 2021a; Martin, et al, 2021b).

### I perceive CS is relevant because ...

... it would help me prepare my students for higher education.	<i>Response options for each item:</i> <input type="radio"/> Definitely true <input type="radio"/> Moderately true <input type="radio"/> Somewhat true <input type="radio"/> Slightly true <input type="radio"/> Not true at all
... it was important to me that all students have the opportunity to take CS courses.	
... it would help prepare my students for future jobs.	
... I wanted more traditionally underrepresented students to learn CS.	
... I believed that CS could open doors to economic independence or upward mobility for my students.	

Table 13. Relevance of CS. Adapted the Motivation to Teacher Computer Science (MTCS) Scale (Martin, et al, 2021a; Martin, et al, 2021b)

## Do

The survey instrumentation discussed in the Plan section and provided in the Appendix will be most advantageous if implemented at specific times before, during or after the PD offering. We recommend PD providers consider the following questions, all of which are connected to “what are you going to measure?”:

### What data should be collected pre-PD only?

Pre-intervention only measurements provide valuable information on the individuals participating in the intervention and the environments in which they teach as a way to plan for purposeful learning in the PD offering. For example, if the facilitator learns that several participants have students who are emergent bi/multilingual language learners, there may be opportunities for the facilitator to adapt or modify their presentation to ensure that needs of students are addressed (e.g., recommending how to bring in culturally relevant practices that are particularly engaging for English language learners).

### What data should be collected pre- and post-PD?

Pre- and post-PD data can provide evidence on the impact of the PD offering. For example, at the start of a PD participants may self-report a low level of interest in teaching CS, but then after the PD they may express greater interest. This increase would indicate that the PD is having a positive impact on participants.

### What data should be collected immediately post-intervention only?

Immediate post-PD data can provide evidence on the impact of the PD. For example, participants can express their overall satisfaction with the program after it has concluded.

### What data should be collected months after the PD?

Longitudinal data can provide evidence on the impact of the PD (e.g., program satisfaction) or on the long-lasting impact after the participants have had the opportunity to apply the material (e.g., after one year of implementing the knowledge learned in the classroom). For example, gauging participants’ self-efficacy prior to and immediately after will give an indication of how the participant changed only from the PD. Checking their self-efficacy at the end of the teaching year can provide the PD providers with even more information about how teachers used the PD to build confidence teaching CS. However, if the PD providers do not have the time or resources to collect data at a point in time several months after the PD, then we recommend you collect this data immediately after the PD.

Each of these data points are part of a culture of continuous improvement for the PD provider. The survey instruments can be set up prior to the PD offering using a secure survey system.

A possible schedule for collecting data is shown in Table 14. Again, this is dependent upon the PD providers' needs.

Pre-PD (During registration)	Pre-PD		Immediate Post-PD	Longitudinal Post-PD
	During registration	During registration or at start of PD session		
<u>Demographics</u> <ul style="list-style-type: none"> <li>○ Participant General Demography</li> <li>○ Participant Professional Attributes</li> <li>○ School Attributes</li> <li>○ Student Attributes</li> </ul>	X			
<u>Beliefs</u> <ul style="list-style-type: none"> <li>○ Self-Efficacy</li> <li>○ Interest Teaching &lt;PD topic&gt;</li> <li>○ Perspectives on Relevance of &lt;PD topic&gt;</li> </ul>		X	X	X*
<u>Program Satisfaction</u> <ul style="list-style-type: none"> <li>○ Logistics</li> <li>○ Learning Environment</li> <li>○ Engagement</li> <li>○ Course Pace</li> </ul>			X	
<u>Knowledge</u> <ul style="list-style-type: none"> <li>○ Content</li> <li>○ Pedagogical</li> <li>○ Technological</li> </ul>			X	X*

Table 14. Data collection points in time.

\*We recommend longitudinal data collection only if the PD provider has time and resources to collect and analyze the data.

## Study

To guide data-driven improvements to the PD offering, the next step for PD providers is to analyze the data that participants provide through the various surveys. This analysis could indicate areas of strength for the PD as well as areas of growth.

As a start, we recommend that providers analyze the survey data separately and in aggregate using descriptive statistics (see below). However, there are many ways in which the data can be analyzed (e.g., measuring correlations between different responses). If you have a researcher or evaluator on your team or within your district (if your PD is part of a district) or other broader team, then we recommend working with them to analyze the data.

For PD providers that may not have assistance with analysis, we provide here a thumbnail sketch of our recommendations for basic analysis under each section below.

## Pre-PD Only Measurement

The pre-PD data can be analyzed in a way to understand the demographics of the participants to ensure that the PD is meeting participants' needs. We recommend considering the aggregated responses to each of the questions and sharing that data with the facilitators, aligning responses to the intended offering. Aggregated responses that are presented as **percentages** will provide information for PD providers to highlight and share with facilitators for tailoring their presentations of materials.

## Post-Data Only Measurement

For the program satisfaction measures, we recommend changing text values starting with "Highly" or "Definitely" and replace them with a numeric value of 5, "Moderately" with a numeric value of 4, "Somewhat" with a numeric value of 3, "Slightly" with a numeric value of 2, and "Not at all" with a numeric value of 1. By doing this, you can calculate the **average (mean) scores** and learn areas of strength and to improve from the responses. It may also be helpful to analyze **standard deviation** to understand the spread of the means both pre- and post-PD.

## Pre-Post Data Measurements

In its simplest form, comparing the **average (mean) scores** of pre- and post-data measures can provide insight for making basic changes. Individual items in each Beliefs category can be analyzed as a whole. That is, to analyze Self-Efficacy you would conduct the following steps (or algorithm) for both the pre- and post-responses:

- Replace text responses with numeric values ("Highly" or "Definitely" with a numeric value of 5, "Moderately" with 4, "Somewhat" with 3, "Slightly" with 2, and "Not at all" with 1 to conduct this analysis).
- Calculate the average (mean) for each of the questions
- Add all five means together
- Divide the sum by the number of questions (e.g., for Self-Efficacy, there are 5 questions)

Conducting this analysis on the pre-values and the post-values for Self-Efficacy then provides evidence of the impact of the PD on participants' self-efficacy. The same steps can be used for Interest Teaching CS and Perceived Relevance of CS (note that the number of questions is 6 for Interest Teaching CS and 5 for Perceived Relevance of CS).

Using a bar chart and placing pre- and post data next to each other can offer a simple visual comparison of the differences. For more information, we recommend also calculating **standard deviation** and using a **box-plot or whisker chart** to visually see differences and changes across time.

If a more sophisticated analysis is being conducted, like a **paired-samples t-test**, then we recommend an **additional item be added** to the pre- and post-surveys so a match can be made across the participants. We recommend that a unique "code" be used that participants can enter on the pre- and post-surveys. The code may consist of anything that could be remembered and be considered unique, like a string of letters or numbers such as the participant's middle initial, their last letter of their last name, the last digit of their phone number and the last digit of their zip code on each form collected.

The longitudinal post-PD data would be analyzed to see if the PCK and beliefs changed or stayed the same from the immediate post-PD instruments. When the data is collected, analyze the information independently and then add context by comparing the data with previously analyzed data.

## Act

Building upon the work completed in studying the evidence in the previous step, the next step is to *act* upon that evidence by creating a plan to improve the PD. This embraces the concept of data-driven instruction for the PD offering.

The evidence will show areas of strength and areas for growth. For instance, the survey data regarding logistics may indicate needed changes to the registration process for user ease. The survey data focused on the learning environment may indicate that existing strategies to foster collaboration should be continued or new ones introduced. Further, the data from the beliefs and knowledge survey items may indicate where the PD offering is (or is not) aligned with the PD goals. We recommend that PD providers identify the areas of strength throughout the surveys and areas of growth using a three-step process. First, identify the areas of strength based on the evidence—those areas where the post-surveys indicate high averages. Second, identify the areas that were not as effective, or those post-surveys with low averages. Finally, develop recommendations for change based on the weaknesses.

Since change requires time and resources, we recommend prioritizing the recommendations so that the top 3-5 are addressed in the next PD offering. As the PD offerings continue to be offered, this process will enable the PD providers to have a more impactful offering in future years.

Areas of strength based on the evidence	Areas of weakness based on the evidence	Recommendations for change

Table 15. Template for identifying areas of strength, weakness, and recommendations for change for future PD offerings.

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## Appendix A. Demographic Data Instrumentation

This Appendix presents all of the suggested items for demographic data collection presented in previous sections.

### Participant General Demography

1. What is the gender with which you most closely identify?

Cisgender Female  
Cisgender Male  
Transgender Female  
Transgender Male  
Non-Binary  
Other [please describe]  
Prefer not to say

2. Which pronouns do you prefer to use? Choose all that apply.

He/Him  
She/Her  
They/Them  
Other pronouns [please describe]  
Prefer not to say

3. What is your race/ethnicity? Choose all that apply.

Asian American and Pacific Islander	Indigenous Pacific Islander
Black/African Descent	Latino/a/e
Central Asian	Middle Eastern/North African
East Asian	South Asian
Hawaiian Aboriginal Descent	Southeast Asian
Indigenous (Guam)	White/ European Descent
Indigenous (Native to America)	Other pronouns [please describe]
Indigenous (Native to Alaska)	Prefer not to say
Indigenous (Polynesian)	

4. Do you have a long-lasting or chronic condition (such as physical, visual, auditory, cognitive, emotional or other) that requires ongoing accommodations for you to conduct daily life activities (such as your ability to see, hear or speak; to learn, remember or concentrate)?

Yes  
No  
Prefer not to answer

Follow-up question if Yes: What accommodations, if any, do you need to be fully engaged in the PD?

## Participant Professional Attributes

5. What is your current role? Choose all that apply.

*\*PD provider: Depending on your needs, you may choose to ask specific grade levels currently taught.*

Early Childhood Teacher (PK-2)  
Primary Teacher(3-5)  
Middle Teacher (6-8)  
Secondary Teacher (9-12)

Teacher- Leader or Instructional Coach  
School Level Administrator  
District Level Administrator  
Other (please specify)

6. Including this year, how many years have you taught in K-12?

I have not yet taught  
1 year (this is my first year)  
2-3 years  
4-5 years

5-10 years  
11-15 years  
16-25 years  
More than 25 yrs

7. Including this year, how many years have you taught CS in K-12?

I have not yet taught  
1 year (this is my first year)  
2-3 years  
4-5 years

5-10 years  
11-15 years  
16-25 years  
More than 25 yr

8. How did you gain your opportunity to teach CS?

Volunteered  
Assigned with choice  
Required with no choice

9. What are your areas of certification? (open ended)

*\*PD Provider: Based on certifications available for your region, you may want to display options for choosing.*

10. What subjects do you teach? Select all that apply.

*\*PD Provider: Based on certifications available for your region, you may want to display different options for choosing.*

Across all subjects (e.g., primary school teacher)  
Arts / Music  
Computer Science  
History / Social Studies

Language Arts  
Mathematics  
Physical Education  
Sciences  
Other (please specify)

11. How do you teach CS/CT?

As a stand-alone subject  
Integrated into other subjects

12. How connected do you feel to other CS teachers?

*\*PD Provider: Based on your needs, this could be divided into two questions for connectedness to other in-district teachers and out-of-district teachers.*

- Highly connected
- Moderately connected
- Somewhat connected
- Slightly connected
- Not connected at all

## School Attributes

13. Do you have access to Assistive Technologies to support students with disabilities through your school or district?

- Yes
- No

14. Do you have access to Assistive Technologies to support emergent language learners?

- Yes
- No

15. Do students have access to a computer lab or computer?

- Yes, access to a computer lab for instruction.
- Yes, 1:1 student device access
- No access to a computer lab or computers

16. What type of software permissions does your school/district have?

- Permission to have software installed on school computers
- Permission to install software on school computers through exemptions only (i.e. connected to an approved curricula or direct education purposes)
- No permissions to have software installed on school computers

17. Is your school a Title I school?

- Yes, school is identified as a Title I School
- No, school is not identified as a Title I School

18. What type of location is your school located in?

- City
- Rural
- Town
- Suburban

## Student Attributes

19. How many students do you teach per year?

- 0-20 students
- 21-50 students
- 51-100 students
- More than 100 students

20. What are the gender demographics of your students (by percentage)?

*\*Information based on student reported data to the district only.*

- Cisgender Female: \_\_%
- Cisgender Male: \_\_%
- Non-Binary: \_\_%
- Transgender Female: \_\_%
- Transgender Male: \_\_%
- Another Gender: \_\_%

21. What are the race/ethnicity demographics of your students, by percentage?

*\*Information based on student reported data to the district only.*

- |  |                                       |
|--|---------------------------------------|
| Asian American and Pacific Islander: __% | Indigenous (Polynesian): __%          |
| Black/African Descent: __%               | Indigenous Pacific Islander: __%      |
| Central Asian: __%                       | Latino/a/e: __%                       |
| East Asian: __%                          | Middle Eastern/North African: __%     |
| Hawaiian Aboriginal Descent: __%         | South Asian: __%                      |
| Indigenous (Guam): __%                   | Southeast Asian: __%                  |
| Indigenous (Native to America): __%      | White/ European Descent: __%          |
| Indigenous (Native to Alaska): __%       | Other pronouns [please describe]: __% |

22. What is the percentage of your students with IEPs/504s?

Percentage of students with an identified (IEP or 504) disability: \_\_\_\_\_%

23. What is the percentage of your students who are bi/multilingual (ELL)?

Percentage of students identified as bi/multilingual (ELL): \_\_\_\_\_%

## Appendix B. Program Satisfaction

### Logistics

1. How did you learn about this professional development?

Email  
Friend  
Colleague  
Social media  
Professional Learning Network (PLN)  
Other (Please specify)

2. How clear was the communication leading up to the planned professional development?

Highly clear  
Moderately clear  
Somewhat clear  
Slightly clear  
Not clear at all  
There was no communication between registration and professional development.

3. How easy was the process of registering for the PD?

Very easy  
Moderately easy  
Somewhat easy  
Slightly easy  
Not easy at all

### Learning Environment

4. What outside factors, if any, enabled or enhanced your full participation in this PD:

Accessibility of materials and content ( e.g., closed captioning, interpreter, handouts provided)  
Collaborative breakout room/table partners  
Environmental distractions (e.g., temperature, noise levels)  
Internet Accessibility  
Peer/table partners  
Other (please specify):  
None

5. What outside factors, if any, prevented you from fully participating in this PD:

Accessibility of materials and content ( e.g., closed captioning, interpreter, handouts provided)  
Collaborative breakout room/table partners  
Environmental distractions (e.g., temperature, noise levels)  
Internet Accessibility  
Peer/table partners  
Other (please specify):  
None

6. How effective was your facilitator?

Highly effective  
Moderately effective  
Somewhat effective  
Slightly effective  
Not effective at all

### Course Engagement

7. How engaging was the PD?

Highly engaging  
Moderately engaging  
Somewhat engaging  
Slightly engaging  
Not engaging at all

8. How was the balance of collaboration to working independently throughout the PD?

Far too much collaboration  
Slightly too much collaboration  
Just the right balance of collaboration and independent work  
Slightly too much independent work  
Far too much independent work

### Course Pace

9. How would you describe the PD time used?

Highly efficient  
Moderately efficient  
Somewhat efficient  
A little efficient  
Not efficient at all

10. How would you describe the course pace?

- Too fast
- Fast
- Just right
- Slow
- Too slow

## Appendix C. Content, Pedagogy, and Technological Knowledge

### Content Knowledge

1. How much knowledge did you have about <PD topic> before taking this PD?  
This is brand new  
I am aware of it.  
I understand it.  
I can apply it.  
I can teach others.
2. How much knowledge do you have about <PD topic> now?  
This is brand new  
I am aware of it.  
I understand it.  
I can apply it.  
I can teach others.
3. How much has your content knowledge about <PD topic> increased?  
Highly increased  
Moderately increased  
Somewhat increased  
Slightly increased  
Did not increase at all

### Pedagogical Content Knowledge

4. How much knowledge did you have about teaching <PD topic> before taking this PD?  
This is brand new  
I am aware of it.  
I understand it.  
I can apply it.  
I can teach others.

5. How much knowledge do you have about teaching <PD topic> now?  
This is brand new  
I am aware of it.  
I understand it.  
I can apply it.  
I can teach others.
  
6. How much was your pedagogical content knowledge about <PD topic> increased?  
Highly increased  
Moderately increased  
Somewhat increased  
Slightly increased  
Did not increase at all

### **Technological Content Knowledge**

7. How much knowledge did you have about teaching with <digital tools for teaching PD> before taking this PD?  
This is brand new  
I am aware of it.  
I understand it.  
I can apply it.  
I can teach others.
  
8. How much knowledge do you have about teaching with <digital tools for teaching PD> now?  
This is brand new  
I am aware of it.  
I understand it.  
I can apply it.  
I can teach others.
  
9. How much has your knowledge about teaching with <digital tools for teaching PD> increased?  
Highly increased  
Moderately increased  
Somewhat increased  
Slightly increased  
Did not increase at all

## Appendix D. Beliefs and Interests

### Equity

1. How confident are you that *all* students can learn <topic>?  
Highly confident  
Moderately confident  
Somewhat confident  
Slightly confident  
Not at all confident
2. How confident are you that *your* students can learn <PD topic>?  
Highly confident  
Moderately confident  
Somewhat confident  
Slightly confident  
Not at all confident

### Self-Efficacy

3. How thoroughly do you feel that you know all the <PD topic> content you need to teach?  
Highly knowledgeable  
Moderately knowledgeable  
Somewhat knowledgeable  
Slightly knowledgeable  
Not knowledgeable at all
4. How clearly can you explain the most complicated material about <PD topic> to your students?  
Highly clearly  
Moderately clearly  
Somewhat clearly  
Slightly clearly  
Not clearly at all
5. Thinking about growth mindset in particular, how confident are you that you can support your students' growth and development in <PD topic>?  
Highly confident  
Moderately confident  
Somewhat confident  
Slightly confident  
Not at all confident

6. Thinking about self-efficacy in particular, how confident are you that you can support your students' growth and development in <PD topic>?
- Highly confident
  - Moderately confident
  - Somewhat confident
  - Slightly confident
  - Not at all confident

**Interest in Teaching CS. I am interested in teaching <PD topic> because...**

7. ... I thought it would be satisfying.
- Definitely true
  - Moderately true
  - Somewhat true
  - Slightly true
  - Not true at all
8. ... I love learning new things.
- Definitely true
  - Moderately true
  - Somewhat true
  - Slightly true
  - Not true at all
9. ... I thought it would be fun to learn CS skills/concepts.
- Definitely true
  - Moderately true
  - Somewhat true
  - Slightly true
  - Not true at all
10. ... it would provide me with great job security as a teacher.
- Definitely true
  - Moderately true
  - Somewhat true
  - Slightly true
  - Not true at all
11. ... it had more prestige than teaching other subjects.
- Definitely true
  - Moderately true
  - Somewhat true
  - Slightly true
  - Not true at all

12. ... I felt pressure from my district to teach CS (administration or others).  
Definitely true  
Moderately true  
Somewhat true  
Slightly true  
Not true at all

**Relevance of CS. I perceive CS is relevant because ...**

13. ... it would help me prepare my students for higher education.  
Definitely true  
Moderately true  
Somewhat true  
Slightly true  
Not true at all

14. ... it was important to me that all students have the opportunity to take CS courses.  
Definitely true  
Moderately true  
Somewhat true  
Slightly true  
Not true at all

15. ... it would help prepare my students for future jobs.  
Definitely true  
Moderately true  
Somewhat true  
Slightly true  
Not true at all

16. ... I wanted more traditionally underrepresented students to learn CS.  
Definitely true  
Moderately true  
Somewhat true  
Slightly true  
Not true at all

17. ... I believed that CS could open doors to economic independence or upward mobility for my students.  
Definitely true  
Moderately true  
Somewhat true  
Slightly true  
Not true at all