

Article

Teacher Usability and Utility Needs for a Professional Development Passport

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Abstract

Policy makers and educators have increasingly recognized the importance of K-12 teacher professional development (PD) in computer science (CS) to foster student growth and academic achievement. In this exploratory mixed-methods study (focus groups $n = 23$, survey $n = 661$), we addressed two research questions: (1) What features and data do teachers think will enhance the usefulness of an application designed to keep track of their PD-related data? and (2) Which demographic factors are most predictive of teacher ratings? Based on a survey, teachers identified several features and data-related elements that would make the platform useful and usable and add value to their experiences. Notably, the most highly requested data-related items focused on the content and professional credits associated with past CS PD that they have taken (i.e., subjects/grade levels targeted by PD, training hours/continuing education units earned). The most highly rated feature was a catalog of searchable upcoming PD offerings. Further, we noted statistically significant differences in teachers' ratings across various demographic subgroups (i.e., race/ethnicity, teaching experience, disability, gender, and locale) for all potential platform features and data items. This indicates the importance of considering the perspectives of various subgroups when developing a platform that meets the needs of all teachers.

Keywords: professional development; computer science; education; tracking; recording; impacts; shared measures; teachers

1. Introduction

Over the last few decades, policy makers and educators have increasingly recognized the importance of teacher professional development (PD) in fostering student growth and academic achievement, particularly within K-12 computer science (CS) (Darling-Hammond et al., 2017; Ma et al., 2018; Ni et al., 2021). From 2014 to 2021, the number of CS teacher PD programs approximately doubled, with a sharp increase in the number of programs for elementary CS teachers (Ni et al., 2021). Most new CS teachers are prepared through in-service PD and many have limited CS content and pedagogical knowledge (Koshy et al., 2022; Menekse, 2015; Valenzuela, 2019; Yadav et al., 2016). Because CS teachers are often the only CS instructor in their schools, PD provides an opportunity for CS teachers to collaborate with and learn from their peers (Blikstein, 2018; Century et al., n.d.; Ni & Guzdial, 2011; Yadav et al., 2016).

Prior research has identified effective elements of PD. Through a meta-analysis of teacher PD, Darling-Hammond et al. (2017) identified that effective PD is content-focused;



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incorporates active learning; supports collaboration; uses models of effective practice; provides coaching and expert support; offers feedback and reflection; and is of sustained duration. Other research has indicated that designing effective PD involves not only including certain features, but developing a nuanced understanding of teachers' professional activities, motivations, contexts, and how they implement PD concepts into their practice (Kennedy, 2016; Korsager et al., 2022). Systematically collecting data from PD providers and participants, then, is vital to understanding and improving the efficacy of PD offerings.

PD funders like the U.S. National Science Foundation (NSF) have supported a wide range of PK12 CS education projects. In particular, over the last 15 years, the NSF has funded PD through several funding programs, such as CS10K, CSforAll, and INCLUDES (Astrachan et al., 2011). These initiatives have significantly increased the availability of CS teacher PD. However, there remains a lack of uniform and systematic data collection requirements across funding agencies at local, state, and federal levels. Further, despite prior research identifying the importance of collecting data on teacher PD to improve and evaluate program design, few states and local education agencies have developed systems to comprehensively track PD offerings, participation in PD, features of PD, the effectiveness of PD programs, PD participants' background characteristics, or participants' experiences in PD (Darling-Hammond et al., 2017; Grossman et al., 2009; Ni et al., 2021). This inconsistency makes it difficult for funders and others to answer even basic questions regarding PD programs, such as *How many unique PreKindergarten through 12th-grade teachers have participated in CS PD opportunities?* and *Are PreKindergarten through 12th-grade teachers in rural communities engaged in CS PD programs at the same rate as in urban and suburban communities?*

Such an infrastructure could expand opportunities for high-quality PD as well as increase teachers' knowledge about the wide range of opportunities and communities in which they can engage (Goldman, 2001). However, there is limited academic literature regarding CS teachers' preference for data collection and reporting. Considering how a digital platform for recording PD data could be beneficial for a wide range of constituents, our research questions for this study included:

RQ1. What features and data do teachers think will enhance the usefulness of an application designed to keep track of their PD-related data?

RQ2. Which demographic factors are most predictive of teacher ratings?

This study is significant for key invested parties and their needs in PD evaluation, particularly in the field of CS education. It also could enable organizations (like local and state education agencies) to identify participation rates in PD, manage funding, and ensure that PD aligns with strategic goals. PD providers could also use the data to identify gaps and improve PD offerings, customizing content based on recorded teacher needs. Finally, teachers can be the largest benefactors since having a platform could enable them to easily identify and access relevant PD as well as provide them with the capability to easily maintain their PD records across schools and districts.

2. Background

Although researchers have extensively documented the effective elements of teacher PD across various disciplines, there is relatively little academic literature focused on teachers' preferences for PD data collection and reporting. Similarly, while there is a significant focus on tracking K-12 students' data, there is little research provided on the challenges and issues of collecting data about teachers' PD. In this section, we provide a background of related research that sets the stage for our study.

2.1. Existing Approaches to PD Inventorying

Records of PD and learning are often an essential component of professional advancement and success, both within and outside of the K-12 teaching profession (Gräther et al., 2018). Physical logs and paper certificates are one method that academic institutions, education agencies, and PD providers have used to help students and professionals maintain records regarding their own professional learning and skills. However, physical logs and paper certificates can often be an inefficient method to deliver, store, search, and verify, creating barriers to quickly communicate, compile, and analyze information.

Electronic logs have been one method to overcome some of these inefficiencies created by physical record keeping. For example, in the mid-2010s, the U.S. National Science Foundation (NSF) requested that Principal Investigators of CS10K-funded projects complete electronic logs in Microsoft Excel to report CS teacher and student participant characteristics, allowing NSF to collect data directly from providers and researchers without storing large amount of paper documents (National Science Foundation, 2017). While electronic logs can address some inefficiencies created by physical logs and certificates, they still create barriers to compiling data across users and integrating multiple data sources.

To overcome these difficulties, developers have developed web-based, electronic solutions which provide unique interfaces for different types of users and automatically compile information into a relational database. For example, developers at the University of Missouri created iTRAX, a web-based system used in their teacher preparation courses (He et al., 2006). The iTRAX system consists of modules for student teachers to document their field experiences in a digital log and for host teachers to input data, including evaluations for their student teachers and demographic characteristics of students in their classroom. This system integrates information into a backend database. This centralized database facilitates the centralized tracking of student participation in teacher preparation experiences and permits university administrators to easily search and analyze data on their students.

Another example of a digital, web-based solution was developed by course directors at Campbell University's College of Pharmacy and Health Sciences (Pound et al., 2024). Course directors developed an electronic questionnaire for pharmacy students to document curriculum and co-curricular activities as they progressed through their program. The questionnaire data was designed to automatically feed into a centralized database, which enabled students and faculty to quickly sort through personal and PD activities at individual and cohort levels.

2.2. Technological Considerations for PD Passports

With any platform, quality user interfaces can lead to positive user experiences. Morville (2004) introduced a user experience honeycomb that identifies seven key factors of a meaningful user experience (Morville, 2004), including being useful, usable, desirable, findable, accessible, credible, and valuable (see Figure 1). They cover the range from ensuring that users want to use the system to fill a need to ensuring that the system is credible and trustworthy. Although other frameworks have been developed since 2004, this framework accounts for many key aspects of user design to consider.

Educators are not always considered when designing and implementing systems that store Personally Identifiable Information (PII), which often have a higher bar to be perceived as credible. For example, in 2021, a reporter in Missouri discovered that the Social Security numbers for PK-12 educators, including teachers, were visible in the webpage source code—codes that are easily viewable on most browsers (Cramer, 2021). This major privacy flaw illustrates the need for careful planning and implementation of teacher data.



Figure 1. Morville’s user experience honeycomb (Morville, 2004).

Educators have limited time beyond their regular responsibilities (Geiger & Pivovarov, 2018) and a user-friendly design that has a simplistic and easy-to-use interface is necessary for a successful PD passport. In addition, there is a wide range of educators teaching diverse programs, subject areas, and grade levels—any such system would also require awareness of these differences and be adaptable to meet all teachers’ needs.

There is limited research on features for digitally recording PD participation. Ramsey et al. (2017) discuss the development of a system to track skills of teachers and pre-service teachers. While the crux of their system is to provide ways for teachers to add the practical skills they learn on the job, the system provides institutions and organizations the capability to add descriptions of skills, learning resources associated with skills, and skills taught in their offerings. While Reinking et al. (2022) provide details on what information could be collected related to teacher PD, particularly in CS education, the authors did not integrate these scales into a digital platform. Similarly, many researchers have used various tools to collect data related to the impacts of PD (Falkner et al., 2019; Rich et al., 2021), but it is challenging to find research on digital systems that directly collect data about the impacts of PD on teachers and their students.

2.3. The Concept of PD Passports

Almost all states require teachers to participate in PD to obtain and renew teaching licenses; however, most states do not require robust data collection on the effectiveness of PD and do not track teacher participation in PD beyond what is required to meet licensure requirements (Holmberg, 2021; Loeb et al., 2009). A lack of data collection systems and requirements can oftentimes lead CS educators to struggle to advance in their careers and obtain credentials (Gal-Ezer & Stephenson, 2010). Moreover, a lack of recognition of professional achievements and learning can negatively affect teachers’ self-efficacy, professional identity, and satisfaction (Keller, 1999; Ni & Guzdial, 2011; Qian et al., 2018; Sentance & Csizmadia, 2017).

A lack of systematic and comprehensive tracking of teacher PD also creates barriers for PD providers to understand teachers’ past participation in PD and teachers’ professional needs. Additionally, a lack of centralized PD tracking creates barriers for states to understand their teacher workforce and monitor investments into improving teacher effectiveness.

A platform housing teacher PD passports offers multiple benefits and address many of these barriers: such a system can prompt teachers to reflect on their learning and growth, provides PD providers with insights into teachers’ experiences and backgrounds

for tailoring offerings, and enables administrators to assess efforts like school improvement initiatives (Goldman, 2001). Digital product platforms, as part of the circular economy, are being developed to share data across various interested parties (Ducuing & Reich, 2023). The medical community has also seen passports for PD to be beneficial to training clinicians (Murphy et al., 2023). The Interprofessional Education (IPE) Passport is less about tracking specific PD and more about identifying competencies that align with accreditation and using the passport to keep records of competencies achieved among health professionals (Hosseini et al., 2019). Similarly, Newby et al. (2016) align a passport-style system with competencies to provide badges when competencies are achieved, combining elements of learning management and content management.

At a state level and related to PK-12 teachers, Delaware has developed a centralized PD Management System; this system tracks teachers' participation in PD and directly integrates that data with the state's licensure database (Connally & Tooley, 2016). Delaware also offered local education agencies in the state free access to BloomBoard, which offers and monitors teacher PD directly through its platform.

2.4. Summary and Theoretical Framing

Through extensive searches that three of the authors conducted in Google Scholar, we found only a few studies that directly or indirectly focus on the specific needs of teachers and their PD-related data, including among issues related to data privacy (Ducuing & Reich, 2023). This clearly points to gaps in the understanding of how PD logs can be used across diverse educational contexts. Beyond what is mentioned above, there is a need for further exploration on emerging trends in systems, including AI-based recommendations and personalized PD pathways. Thus, this topic aligns with our exploratory research on how teachers view the utility and usability of data tracking systems.

Expectancy-value theory suggests that individuals' motivation to engage in a task is driven by their expectation of success (expectancy) and the perceived value of the task (value) (Eccles & Wigfield, 2020; Wigfield & Eccles, 2000). When evaluating the usability and usefulness of a new platform, this theory aligns with Usable, Useful, and Valuable factors of Morville (2004)'s User Experience Honeycomb. Valuable directly align with Value, since if users perceive the platform as beneficial to them (or valuable for their goals) and their work (e.g., saving time, enhancing productivity, supporting their needs), they are more likely to see it as Useful. Value and usefulness, then, directly align with the theory's intrinsic, attainment, and utility value concepts. Asking potential users about features that would make the platform Usable for them taps into their beliefs about how easy or difficult the platform is to use. If users perceive the platform as intuitive and easy to use, their expectancy of success increases, making them more likely to adopt it.

Expectancy-value theory suggests that these aspects—usability (expectancy) and value (value) that supports usefulness—must be supported in the platform to encourage its adoption. The future measurement of this may include a survey that defines usability, value, and usefulness. If usability scores are low, users may doubt their ability to successfully use the platform, reducing motivation. If value and usefulness are rated low, even a highly usable platform might not be adopted because users do not see the value.

3. Methodology

To answer our research questions, we chose an exploratory sequential mixed-methods approach (Creswell & Plano Clark, 2018) consisting of three rounds of focus groups and one quantitative survey, discussed below. The quantitative strand was designed based off the qualitative strand results. We chose the exploratory-sequential mixed methods design since limited research exists that focuses on the features and data that teachers would

want in a platform designed to track PD data. An open qualitative approach let us gather a broad swath of ideas generated by these populations. We then wanted to determine the generalizability of these ideas through a cross-sectional survey to ascertain the extent to which ideas generated in the qualitative strand were endorsed by a broader sample of teachers.

At a broad level, we adopted a pragmatist approach to our inquiry (Morgan, 2014). That is, we tailored our methodologies to our needs; we were not constrained by one particular philosophical approach to research. The pragmatist paradigm asserts that research results ought to be useful and actionable. Since we are building a platform designed to help many different professionals track CS PD data, our research needs to yield actionable results. Ethics approval was obtained through one of the author's affiliated Institutional Review Board (IRB), and the study was established to be exempt.

3.1. Positionality

Our interdisciplinary team is committed to advancing equitable CS education for all students. With formal training in diverse research methodologies and substantial teaching experience, we prioritize creating meaningful learning opportunities in CS education. We advocate for data-driven decision-making and policy development, recognizing the value and limitations of both quantitative and qualitative approaches. We thoughtfully selected our methods to align with the unique needs of each research question, ensuring robust and relevant insights. We analyzed data among various subgroups to ensure that we explored the needs of teachers with different backgrounds, particularly those from historically marginalized groups.

3.2. Qualitative Methodology

The qualitative strand proceeded through a series of three focus groups with the same group of CS teachers. In these focus groups, we aimed to identify key features of, potential challenges to, and benefits of the proposed digital PD platform. Since these goals aligned with assessing the needs of teachers, we employed practices for a needs assessment as defined by (Liamputtong, 2011). Each focus group session offered a deeper exploration of teachers' needs, focusing on the following topics:

- Week 1: Discussed the challenges CS teachers face in managing their PD, including the types of PD they have taken and their completion certificates.
- Week 2: Focused on identifying essential features and data needs for the platform, such as integration with other tools and apps, the ability to add detailed information about PD offerings, data management, and advertising PD opportunities.
- Week 3: Shared findings from teachers from the first two weeks. Participants were asked to comment on areas of agreement or disagreement and provide additional suggestions or questions to enhance the findings.

3.2.1. Participant Recruitment and Selection

We disseminated a screening questionnaire that measured respondents' professional role (e.g., grade level taught), location (by state), whether they worked in a rural community, and years of teaching experience. We also asked for their gender, race/ethnicity, disability status, and their availability to attend the focus groups at pre-established dates and times.

We then sent the questionnaire via direct email to Computer Science Teachers Association (CSTA) members. Over 680 teachers completed the screening questionnaire. We used a purposeful sampling method to select participants to invite to focus groups. After their availability was established, we then considered a diverse set of participants across gender, race/ethnicity, disability status, and teaching in a rural vs. non-rural setting. Based on

these criteria, 19 CS teachers were invited to attend the series of three virtual focus groups. These 19 teachers were divided into two separate groups to maintain a reasonable focus group size. Of the CS teachers ($n = 16$) that participated in the focus groups, $n = 8$ were women, $n = 8$ were men, and $n = 7$ (44%) served rural communities. The participants identified as White ($n = 7$), Hispanic/Latinx ($n = 3$), Black ($n = 5$), and Asian ($n = 1$). Thirty-one percent ($n = 5$) identified as having a disability.

3.2.2. Data Collection

We collected data through weekly virtual meetings on Zoom, recording each session and recording teacher answers to questions posed in a shared document. While sessions were scheduled for up to 60 min, Week 1 lasted 31 and 33 min, Week 2 lasted 32 and 39 min, and Week 3 lasted 38 and 32 min. During these meetings, we asked participants questions to understand their challenges related to keeping track of the PD they have taken. Sample questions we posed included:

- How do you currently keep track of your CS PD that you take?
- Have you had any challenges with keeping track of your CS PD? If yes—what challenges, if any, have you encountered in recording and managing your CS PD activities? If no—what opportunities do you think a digital platform could offer for teachers who want to grow their CS PD experiences?
- In your opinion, what would make the adoption of a digital platform that keeps track of your CS PD successful among CS teachers?

Focus-group participants received a gift card of up to \$50 as a token of appreciation, with the exact amount determined by the number of sessions they attended.

3.2.3. Data Saturation and Analysis

By the end of the focus groups, participants were describing in detail their thoughts on what they would want in a platform and what they did not view as necessary. At the third focus group session, participants were no longer generating new ideas but, rather, focused on confirming or disputing previous findings. Therefore, we concluded that data saturation had been achieved.

We used a qualified service to transcribe each focus group and combined them with the notes captured, which were used alongside the session questions. We also included any relevant comments from the Zoom chat in the analysis. To make sense of the data, we carefully read through all data collected and made a list of the proposed features and then grouped them as either features (actionable) or data-related items (static). These categories are presented in the Findings section.

3.3. Quantitative Methodology

Using insights from the focus group results, we developed a survey to collect quantitative data from a broader range of CS teachers. In the survey, we created the 30 items from the focus group discussions, categorizing them as *features* or *data-related* items. Features speak more to the capability offered by the platform and data-related items speak more to the actual data that would be stored by the platform. While there is overlap between these two sets of items, this categorization created a way to organize and think about the data. We paid careful attention to developing each survey item to ensure clarity and brevity.

The survey asked participants to rate the importance of these features and data items for a platform designed to track their PD participation. We created the survey using RED-Cap (Harris et al., 2009). Ratings were provided on a scale from 1 (not at all important) to 7 (extremely important) for all items. Additionally, we collected demographic information from the participants (e.g., race/ethnicity, gender, years teaching, disability status).

3.3.1. Participants

The survey's sample frame was a list of all Computer Science Teachers Association members. We emailed a link to complete the survey to all sample frame members. Survey participants could optionally enter a drawing to win one of ten \$50 gift cards as a token of appreciation for their engagement. The survey remained open for two weeks in the Spring of 2024.

The analytic sample of teachers ($n = 661$) was mostly women (65%), White (60%), served a Title I school (68%), and did not have a disability that would affect their use of technology (93%; see Table 1 for detailed demographics). Teachers reported an average of 17.31 years of teaching experience ($SD = 9.36$, $Median = 17$, $Min = 1$, $Max = 50$) and an average of 7.54 years of experience teaching CS ($SD = 7.27$, $Median = 5$, $Min = 0$, $Max = 44$).

Table 1. Sample descriptive statistics for categorical variables.

	N	%
Teach PreK-5th Grade	128	19.36
Teach 6th-8th Grade	121	18.31
Teach 9th-12th Grade	284	42.97
Teach Multiple	128	19.36
Black or African American	102	16.64
Asian	37	6.04
Hispanic/Latinx	36	5.87
Native American or Alaska Native	5	0.82
White	392	63.95
Multiracial	35	5.71
Race/Ethnicity self-described or not provided	54	8.17
Gender: Man	194	29.35
Gender: Woman	429	64.90
Gender: Non-binary	2	0.30
Gender: Multiple	4	0.61
Gender: Self-described	1	0.15
Gender: Answer Not disclosed	31	4.69
Disability that affects use of technology: Yes	13	1.97
Disability that affects use of technology: No	612	92.59
Disability: Answer Not disclosed	36	5.45
Teach in a Title I School	452	68.38
Locale: City	210	31.77
Locale: Suburb	230	34.80
Locale: Town	71	10.74
Locale: Rural	122	18.46
Locale: Multiple	28	4.24

While women comprised 65% of the sample, this reflects the fact that approximately 77% of K-12 teachers in the U.S. are women (Schaeffer, 2024). Therefore, we did not adjust our sample for bias.

3.3.2. Data Analyses

For RQ1, we used descriptive statistics (mean and standard deviation) to determine which items were most highly rated by participants. To answer RQ2, we entered all demographic variables (stepwise, with $p < 0.10$ required to enter the model) into separate ordinal logistic regression models (one for each item) to determine which was the most

predictive of ratings of the 10 highest-rated items (as determined in RQ1). In this way, we can determine which factor accounts for unique variance in teachers' ratings of each item. Ordinal logistic regression was used because the item ratings (dependent variable) were given on an ordinal Likert-type scale (i.e., 1 through 7).

Unfortunately, very few teachers identified as Native American/Alaska Native ($n = 5$) or Native Hawaiian ($n = 4$). For this reason, we had to exclude these categories from the analyses reported in this section due to insufficient sample sizes. However, all of the teachers who identified as Native Hawaiian also identified as at least one other race/ethnicity, and so these teachers are included in the "Multiple" race/ethnicity category.

Similarly, due to extremely low subsample sizes among teachers who identified as non-binary, multiple genders, or self-described, we compared participants who identified as men to those who identified as women and the other possible gender identities listed above.

4. Qualitative Results

Many users suggested adding and linking to other badging systems to reward teachers for PD participation, including a forum for teachers to share what they are learning in the PD, identifying whether industry certification is available, and informing teachers when their license is set to expire and whether they have met the minimum standards for license/certification renewal.

4.1. Profiles

When considering the profile data (i.e., data about themselves and their schools), teachers expressed typical data that they would like to see the platform be able to store. This includes name, email, qualifications, and areas of expertise, as shown in Table 2. Some teachers stressed the importance of having access to their CS PD data if they changed schools and wanted the option to connect it to their personal emails.

Table 2. Profile data suggested by teachers.

Teacher Profile Data	School Profile Data
Name	Grade bands taught in the school
Email	Geographic indicators
Current position	Title I Status
Years teaching	# of CS courses offered in the school
Years teaching CS	# of CS teachers on campus/in district
College degrees	% of students with IEPs
Certificates earned/grad credits, etc.	% of students who are learning English
Licensure	Student demographics
Whether a user is interested in providing PD or sharing their expertise	How CS is taught (integrated, stand-alone, both) of students
Teaching assignments (courses they teach)	
Special areas of expertise	
Organization memberships	
Whether user is interested in networking and, if so, social media handles	

Overall, teachers wanted the option to select what demographic data to include in their profiles, and multiple teachers did not wish for the user profile to include any teacher demographics (such as gender identity or race/ethnicity). One teacher stressed that not everyone feels comfortable sharing this data.

School profile data was also discussed. Teachers noted that they would like the platform to offer the capability for them to specify the grade bands in their school, the school's geographic locale, the Title I status of the schools, and more.

4.2. Essential Platform Features

Teachers created an in-depth list of what should be included in the information about the CS PD offerings (see Appendix A), including its title, the grade level targeted, the content taught, pedagogy covered, who offered the PD and the presenter/provider contact information. They also wanted to know whether CS PD is intended for stand alone courses or integrated lessons (including which subject CS is integrated into) and materials/resources offered during the PD. Additional data and features participants requested included:

- Date and time of PD.
- Location (Online or in-person; if in-person, provide location).
- Training hours, points, and/or Continuing Education Units (CEUs) earned.
- Accessibility and Language options of the PD.
- Knowledge level required of participants.
- Format of PD (hands-on, research, workshop, learning lab).
- Frequency (one-time, continuing group, etc.).
- Cost for the PD.
- Certificate earned.

While multiple participants said that CS PD offerings should include the CSTA standards that the PD addressed, some participants stated that they follow the CS standards unique to their state and that would be more valuable to them. Other participants addressed similar concerns with assessing hours earned for PD since many states use different measurements of PD credits (e.g., points, hours, CEUs).

Overall, teachers shared that they want forward-looking considerations such as a catalog of upcoming PD opportunities searchable across standards and grade bands. Additionally, teachers requested the usage of QR codes for quick connecting to upcoming PD events. Teachers also shared that they would like to be able to search (viewable in platform and downloadable as PDF or .csv file) for each CS PD opportunity by grade level and subject matter, topic/pedagogy covered, date and location, standards taught, training hours, points, and/or CEUs received, and format (e.g., hands-on, research, workshop, learning lab).

There were many discussions about the data, including the teachers' CS PD hours attempted. Some teachers voiced that they were concerned that their school and district leaders would use this information to micromanage them. Participants were also concerned that displaying their hours accumulated towards state mandated CS PD hours could create a negative effect on their career. One participant noted a "possible concern by teachers if their attendance or completion of a PD is being used evaluatively by administration."

Participants noted that the platform should meet required accessibility guidelines for federally funded websites/apps, which is currently the Web Content Accessibility Guidelines (WCAG) AA ([World Wide Web Consortium](https://www.w3.org/WAI/standards-guidelines/wcag/), 2025).

4.3. Training and Support

When asked about training that would help teachers use the PD training system, teachers requested both in-platform and external training. In-platform training included videos and text-based training. Supplemental to the platform, teachers would like to see hands-on training sessions and a live webinar to kick off the platform's features. Teachers also requested data security training for the platform for themselves and others who might use it.

Additional in-platform support included getting started resources, a help page, an FAQ page, live chat, and multilingual support to make the platform accessible to a global audience. Participants also requested training for the platform that was specific to their

job/position and an introduction to or demonstration of the platform so that leadership can determine whether it meets the needs of the organization.

4.4. Features to Further Increase Usability and Usefulness

Participants also requested a searchable catalog of upcoming PD opportunities with filters across categories (grade level, location, subject area covered, etc.), PD dates, and PD registration links to increase the usability and usefulness of the platform. This includes listing annual conferences relevant to CS teachers, presenter opportunities, opportunities that are a series (let participants know of the next series), and other national and state level PD.

Teachers wanted the platform to offer the capability for teachers to add a professional growth plan so that their PD can be mapped to their individualized plan. Participants also mentioned many additional features that would be useful to have, including a badge system to incentivize teachers, a forum for teachers to share what they are learning in the PD, and QR codes for quickly connecting to upcoming events. Further, multiple teachers voiced that they would like to leave a review/rating after they completed a CS PD. When asked what the rating system should look like, teachers were uncertain, ranging from thumbs up/thumbs down and a five-star rating to “I recommend this training (Yes or No)”.

Notably, few participants commented on privacy and security. However, participants shared their thoughts on the platform’s login process, with one participant suggesting multi-factor authentication (MFA) over single sign-on (SSO).

5. Quantitative Results

5.1. RQ1: Features and Data That Teachers Want

The survey captured both the specific data points teachers wanted the system to store and the platform features they considered essential. To answer research question 1, What features and data do teachers think will enhance the usefulness of an application designed to keep track of their PD-related data?, we found the participants’ most and least desired features or points of data for the platform, with the top 10 of each presented in Tables 3 and 4, respectively.

Table 3. Teachers’ top ten desired features.

Features	Mean (SD)	Median	Min-Max
Catalog of searchable upcoming PD offerings	5.77 (1.30)	6	1–7
Place where users can contribute content, such as mini-courses, webinars, or a	5.42 (1.35)	6	1–7
Automatic reminder for teachers about their license expiration	5.36 (1.74)	6	1–7
CS PD offerings mapped to CSTA standards	5.32 (1.50)	6	1–7
Indication if industry certification is available upon completion of a CS PD	5.30 (1.62)	6	1–7
For teachers to discuss what they are learning in the CS PD offering	5.28 (1.47)	6	1–7
Indication of whether you have met the minimum standards for license/certification renewal	5.24 (1.73)	6	1–7
Catalog of offerings for formal education (i.e., college coursework, relevant de	5.08 (1.66)	5	1–7
Book/resources exchange among teachers	4.91 (1.62)	5	1–7
Badging system to reward teachers for completing various CS PD	4.74 (1.84)	5	1–7

Table 4. Teachers' top ten desired data-related items.

Data-Related Items	Mean (SD)	Median	Min-Max
Subject/topics targeted by the CS PD offerings	6.05 (1.10)	6	1–7
Grade levels targeted by the CS PD offerings	6.00 (1.19)	6	1–7
Training hours, points, and/or CEU credits available to be earned by each CS PD	5.96 (1.25)	6	1–7
Date and location of each CS PD offering	5.91 (1.28)	6	1–7
List of all of your CS PD completed	5.85 (1.34)	6	1–7
Certifications received for each CS PD offering	5.84 (1.31)	6	1–7
Format of each CS PD offering (e.g., Hands-on, research, workshop, learning lab,	5.84 (1.39)	6	1–7
Total hours of CS PD completed	5.83 (1.38)	6	1–7
List of all CS PD certificates earned	5.74 (1.38)	6	1–7
Standards covered in each CS PD offering	5.71 (1.27)	6	1–7

Notably, even the lowest-rated features received an average rating of approximately 4 out of 7, suggesting that teachers were generally at least neutral or largely positive toward all of items we asked about. Interestingly, teachers tended to rate the data-related items as more important than the feature-related items.

5.2. RQ2: Predicting Item Ratings

To answer RQ2, Which demographic factors are most predictive of teacher ratings?, we entered the following demographic variables as predictors into separate ordinal logistic regression models (by item): years of teaching experience, years of CS teaching experience, the geographic locale of the school teachers serve, self-reported race/ethnicity, and self-reported gender.

Ordinal logistic regression is different from linear regression because it models the probability of an outcome falling into a given category or higher, rather than predicting a continuous outcome. Further, the outcome (i.e., dependent variable) is measured on an ordinal scale instead of a continuous scale—our outcomes (ratings of each item) were measured on a Likert scale from 1–7. For this reason, coefficients associated with each predictor (independent variable) are not as easily interpreted as they are in standard linear regression. Predictor coefficients in ordinal logistic regression are instead expressed as an odds ratio. An odds ratio (OR) represents the odds that the outcome falls in a given category or higher, relative to the odds that it falls below that category (Pituch & Stevens, 2016). Odds ratios are interpreted differently for independent variables that are continuous (e.g., years of teaching experience) vs. categorical (e.g., race/ethnicity) in measurement. The odds ratios for the race/ethnicity predictors (which are categorical) compare the odds that the given group (named in each column header) rates each item at the same or a higher level (i.e., as or more important) compared to the reference group for race/ethnicity (i.e., Black or African American). For *categorical predictors*, $OR > 1$ means the given group has higher odds of rating the item in a higher category or higher compared to the reference group. $OR < 1$ means the given group has lower odds of rating the item in a higher category or higher compared to the reference group.

Tables 5 and 6 show the results of our individual ordinal logistic regression models. All models were statistically significant at the $p < 0.05$ level. The results indicated some notable consistencies among all models. First, teachers' years of teaching experience, their years of CS teaching experience, the geographic locale of their schools, and the Title I statuses of their schools did not predict ratings on these items beyond race/ethnicity and gender. Conversely, teachers' race/ethnicity emerged as the dominant predictor of teacher ratings in all of our models. In fact, the influence of teachers' ethnicity was so strong that teachers'

gender (male vs. women/nonbinary/self-described) was only a statistically significant predictor in fewer than half (8 of 20) of the models—but for all of these outcomes, teachers' race/ethnicity was still a significant predictor. The presence of two statistically significant predictors means that both race/ethnicity and gender account for unique variance in the ratings of these items.

To interpret the results in Tables 5 and 6, first look at which proportional odd ratio is statistically significant (if not multiple). Only the proportional odds ratio(s) that is (are) statistically significant predict ratings of the associated item. The value of the proportional odds ratio (POR) tells us how likely a participant is (relative to the reference group) to rate the item at a given level or higher (i.e., rate the item with a 4 compared to a 5 or above).

For example, the first item in Table 5 shows that men were less likely than women/non-binary/self-reported gender teachers to rate the feature *Catalog of searchable upcoming PD offerings* at a given level or higher (e.g., a 4 out of 7). Similarly, white teachers were less likely than Black or African American teachers to rate that item at a given level or higher.

Further investigating the results related to race/ethnicity revealed the most consistent and large effects emerged for white teachers. Compared to Black or African American teachers, white teachers consistently rated the items as less important. Their odds of rating these items at a given level or higher usually hovered between one-quarter and one-half of the odds of Black or African American teachers.

Although most of the items presented in Tables 5 and 6 were rated differently only by white vs. Black or African American teachers, some items were rated differently by three or more races/ethnicities. For example, *CS PD offerings mapped to CSTA standards* differed among Black/African American, white, Multiracial, and self-described teachers, with the latter three types of teachers having significantly lower odds of rating the item at a given level or higher compared to Black/African American teachers. The same was true of ratings for a *Badging system to reward teachers for completing various CS PD* among Black/African American, Asian, white, and multiracial teachers. Among the data-related items, the same pattern emerged for *Certifications received for each CS PD offering* among Black/African American, Asian, white, and multiracial teachers and for *Standards covered in each CS PD offering* among Black/African American, Hispanic/Latinx, white, and multiracial teachers.

Finally, six of the eight items that were predicted by gender related to data. In all eight of these items, men had lower odds of rating each item at a given level or higher compared to women/non-binary/self-described-gender teachers.

Table 5. Odds ratio (*p*) from ordinal logistic regression models run on *feature* items.

Feature Item	Gender: Man	Asian	Hispanic/Latinx	Race/Ethnicity		Multiple	Self-Described
				NAHA	White		
Catalog of searchable upcoming PD offerings	0.59 (<0.01)	0.74 (0.41)	0.68 (0.28)	0.51 (0.47)	0.53 (<0.01)	0.97 (0.93)	0.26 (0.08)
Place where users can contribute content, such as mini-courses, webinars, or a	0.68 (0.02)	0.58 (0.12)	0.79 (0.49)	0.23 (0.10)	0.50 (<0.01)	0.80 (0.54)	0.21 (0.03)
Automatic reminder for teachers about their license expiration	0.84 (0.27)	0.70 (0.32)	0.94 (0.87)	0.45 (0.35)	0.55 (<0.01)	0.59 (0.15)	0.23 (0.06)
CS PD offerings mapped to CSTA standards	0.92 (0.63)	0.71 (0.34)	0.54 (0.09)	0.79 (0.78)	0.22 (<0.001)	0.36 (<0.01)	0.13 (<0.01)
Indication if industry certification is available upon completion of a CS PD	0.92 (0.62)	0.52 (0.07)	0.95 (0.90)	0.27 (0.10)	0.28 (<0.001)	0.42 (0.02)	0.39 (0.23)
Forum for teachers to discuss what they are learning in the CS PD offering	0.89 (0.51)	0.44 (0.03)	0.70 (0.32)	0.29 (0.14)	0.42 (<0.001)	0.59 (0.14)	0.26 (0.07)
Indication if you've met the minimum standards for license/certification renewal	0.79 (0.15)	0.47 (0.04)	0.84 (0.61)	0.55 (0.47)	0.36 (<0.001)	0.63 (0.23)	0.24 (0.07)
Catalog of offerings for formal education (i.e., college coursework, relevant de	0.83 (0.25)	0.37 (<0.01)	0.59 (0.15)	0.44 (0.37)	0.35 (<0.001)	0.72 (0.37)	0.28 (0.10)
Book/resources exchange among teachers	0.76 (0.08)	1.01 (0.99)	0.72 (0.35)	0.69 (0.66)	0.51 (<0.001)	1.03 (0.94)	0.61 (0.47)
Badging system to reward teachers for completing various CS PD	0.79 (0.16)	0.38 (0.01)	0.83 (0.60)	0.45 (0.30)	0.30 (<0.001)	0.35 (<0.01)	0.42 (0.23)

Note: Variables that were not statistically significant predictors of ratings were excluded from this table for parsimony. NAHA = Native American, Hawaiian, Alaskan.

Table 6. Odds Ratio (*p*) from ordinal logistic regression models run on *data* items.

Feature Item	Gender: Male	Asian	Hispanic/Latinx	Race/Ethnicity		Multiple	Self-Described
				NAHA	White		
Subject/topics targeted by the CS PD offerings	0.62 (<0.01)	1.07 (0.87)	0.61 (0.20)	0.66 (0.69)	0.45 (<0.001)	0.87 (0.73)	0.36 (0.25)
Grade levels targeted by the CS PD offerings	0.64 (<0.01)	1.27 (0.53)	0.88 (.72)	0.81 (0.83)	0.61 (0.03)	0.76 (0.46)	0.23 (0.06)
Training hours, points, and/or CEU credits available to be earned by each CS PD	0.77 (0.12)	0.51 (0.08)	0.58 (0.15)	0.41 (0.41)	0.32 (<0.001)	0.53 (0.10)	0.29 (0.14)
Date and location of each CS PD offering	0.64 (0.01)	0.75 (0.43)	0.81 (0.57)	0.85 (0.88)	0.46 (<0.01)	0.80 (0.55)	0.28 (0.12)
List of all of your CS PD completed	0.65 (0.01)	0.68 (0.31)	0.60 (0.18)	0.65 (0.68)	0.38 (<0.001)	0.55 (0.10)	0.41 (0.29)
Certifications received for each CS PD offering	0.71 (0.04)	0.42 (0.02)	0.75 (0.47)	0.24 (0.13)	0.27 (<0.001)	0.41 (0.02)	0.35 (0.21)
Format of each CS PD offering (e.g., Hands-on, research, workshop, learning lab,	0.66 (0.01)	0.75 (0.43)	0.66 (0.26)	0.59 (0.61)	0.40 (<0.001)	0.51 (0.07)	0.48 (0.38)
Total hours of CS PD completed	0.78 (0.14)	0.52 (0.09)	0.58 (0.14)	0.59 (0.61)	0.38 (<0.001)	0.52 (0.07)	0.38 (0.25)
List of all CS PD certificates earned	0.74 (0.07)	0.59 (0.16)	0.83 (0.62)	0.78 (0.81)	0.38 (<0.001)	0.62 (0.18)	0.44 (0.30)
Standards covered in each CS PD offering	0.99 (0.99)	0.59 (0.15)	0.42 (0.02)	0.32 (0.21)	0.26 (<0.001)	0.40 (0.01)	0.37 (0.25)

Note: Variables that were not statistically significant predictors of ratings were excluded from this table for parsimony. NAHA = Native American, Hawaiian, Alaskan.

6. Discussion

6.1. Findings Across Teachers

Teachers overall agreed on what data should be prioritized within the teacher and school profile with some caveats. Teachers were not comfortable with the platform requiring teachers to provide their demographic data, such as gender, race/ethnicity, and other similar identities. Further, teachers wanted their profiles to be portable throughout multiple jobs and locales and, therefore, wanted their email attached to their personal email address rather than their school email address. Finally, the suggestion to add a feature for teachers to signal that they may be interested in providing PD or sharing their expertise is notable. The CSTA Standards for CS Teachers ([Computer Science Teachers Association, 2020](#)) include indicators encouraging teachers to share their CS knowledge, skills, and practices since there are still few teachers trained to teach CS across the United States.

Regarding the school profile, while some of this data could be incorporated from school-level data provided by the U.S. National Center for Education Statistics (NCES) ([National Center for Education Statistics, 2025](#)), school-level data may change annually, which would require this data to be updated each year. Further, as of the time of this writing, it is unknown whether NCES will continue to collect and share national-level data about schools given recent budget cuts ([Binkley & Toness, 2025](#)) making reliance on this dataset as an auto-update feature less feasible.

Teachers offered many suggestions for how to improve the usefulness of the platform. Most importantly, they overwhelmingly requested data in the platform related to the content and professional credits associated with past PD, such as grade levels and content covered, credit hours or CEUs earned through PD, and the date and location of the PD. They also wanted the platform to provide information about upcoming PD offerings that meet their needs, which they can quickly sign up to attend. These data suggest that teachers view the platform as more useful when it facilitates reporting on the details of past PD and understanding information on potential future PD.

6.2. Variations in Response Across Race/Ethnicity

There were numerous differences in ratings based on race/ethnicity. Teachers who identified as African American or Black consistently rated items in these tables slightly higher, on average, than teachers from any of the other race/ethnicity categories—though the most consistent statistically significant difference emerged between African American/Black and white teachers. In RQ2, we entered race/ethnicity as a categorical predictor in our ordinal logistic regression models alongside gender, years of teaching experience, years of CS teaching experience, geographic locale, and Title I status. Even after adding these other potentially influential factors to our models, race/ethnicity still emerged as the dominant predictor (or at least still an influential predictor) in most of our models.

There are some potential reasons why these differences may have emerged, particularly regarding the items related to teaching standards. Black teachers are more likely to work in urban schools and institutions serving predominantly minority student populations, many of which have limited resources and in which an elective curriculum, such as CS, can be seen as auxiliary ([Farinde et al., 2016](#); [Kincheloe, 2010](#); [National Center for Education Statistics, 2022](#)). These schools often experience significant funding gaps, receiving up to \$2700 less per student in state and local funding compared to schools with fewer students of color. This lack of funding may require Black teachers to justify their professional development and instructional time dedicated to CS. Generally, Black teachers are more likely to have pursued education beyond a master's degree than their peers, with 13% attaining post-master's education compared to 9% of all teachers ([National Center for Education Statistics, 2022](#)). Additionally, Black teachers are more likely to earn certification through alternative

pathways. While 18% of all public and private school teachers entered the profession through alternative certification, this route was taken by 34% of Black teachers (National Center for Education Statistics, 2022). It may be the case, then, that Black teachers are more likely to see cataloging their in-service learning as a necessity to substantiating their professional value.

Additionally, the rules of organizational culture in schools have historically been set by those in the majority, typically by members who are White (Madsen & Mabokela, 2000). Black teachers often face an additional set of challenges and barriers to entering and retaining in the teaching profession, and they leave the profession at higher rates than White teachers (Ingersoll et al., 2017). Black teachers encounter racialized experiences and microaggressions throughout their pre-service preparation and in-service experiences (Champion & Wilson-Jones, 2023; Grace & Aming-Attai, 2023). Compared to their White peers, Black teachers are more likely to report being distrusted by administrators and asked to substantiate their credentials (Grissom & Bartanen, 2022; Mawhinney & Rinke, 2020; Rauscher & Wilson, 2017; Simon & Johnson, 2015). Black teachers also report being asked to take on additional and differentiated responsibilities, manage “difficult” students, and teach lower-level or remedial courses compared to their White peers (Grissom & Bartanen, 2022; Mawhinney & Rinke, 2020; Rauscher & Wilson, 2017; Simon & Johnson, 2015). Additionally, Black and female individuals have historically been excluded from CS domains, and CS is often characterized as being a White and male subject (Belle et al., 2023; Master et al., 2016; Rankin et al., 2021). These factors could explain why Black individuals rated the platform’s data elements and features as more important than other racial subgroups. Black individuals may feel the need to formally substantiate their credentials and present information on their professional development in a centralized platform that is viewed as legitimate. Put another way, Black teachers’ ratings of the items on our survey may have been influenced by underlying concerns about job security, a need to provide evidence that they are qualified, and a motivation to substantiate their work (in other words, prove their worth), particularly in CS (Coleman-King et al., 2023; Ingersoll et al., 2017).

6.3. Variations in Response Across Gender

Across gender, we observed steep differences in response rates (see Table 1), which we attribute to the fact that there are significantly more K-12 teachers who are women than men (Schaeffer, 2024) and that women are more likely to fill out surveys than men (Becker, 2022). Beyond the differences in response rates, there were significant differences in 8 individual item ratings found between men ($n = 194$) and women, nonbinary, multiple genders, and self-described ($n = 436$). Because of the extremely nascent literature available to ground our exploratory study, we were unable to hypothesize why these items were statistically significant while others were not. Further research into this area could shed light on contributing reasons.

6.4. Study Limitations

Participants were recruited from the Computer Science Teachers Association (CSTA), an [association] that supports K-12 CS teachers. Participants needed to be members to be invited to participate. Thus, our sample (and resultant data) is biased towards existing CSTA members.

Although many of our models were statistically significant, the potential explanations for these findings were difficult to formulate (especially regarding gender results). Thus, even though our results were statistically significant, the practical significance may be diminished. Additionally, we ran numerous models separately (by each item), which could have resulted in inflated family-wise Type I error. Nevertheless, the number of significant

results uncovered likely means that true differences and true predictive relationships do exist in these data. Additional future research is needed to verify or refute our results.

The survey that we developed and used for collecting quantitative data primarily originated from the results of our focus groups. Therefore, it may not reflect the evidence from theoretical studies, only what teachers' experiences indicate. However, since little research evidence on what teachers may want in such a platform exists, rooting our survey in teacher needs may contribute to its credibility.

Finally, most of the teachers found most of our items useful/important, which limited the amount of variance in item ratings we observed in the data. This limited variance restricts the amount of information gained through regression and makes any potential true differences among subgroups harder to distinguish. Thus, future research could modify the rating scale used for these or similar items, and/or recruit a more representative sample of teachers to potentially elicit more variance.

7. Conclusions

Defining features and data-related items that can potentially make the platform more useful and usable for teachers prior to the platform being developed is a rigorous software engineering practice. For this platform, we sought to understand what features would be most important for teachers. We learned that the majority of teachers want a set of features that provide the capability for them to track key details on the content (e.g., subjects and grade levels covered) and professional credits (e.g., hours, CEUs) associated with their PD across time. Making this portable accessible to them across their career and providing the capability for them to search for upcoming PD to support their professional learning needs were both rated as highly important.

Notably, we explored the differences in subgroups of teachers to ensure that the responses from the subgroups in the majority did not overshadow the needs from the others, to help ensure that effects of dominant norming were mitigated. This was done to ensure that the platform would meet the needs of all users, rather than just some. Notably, there existed differences in data element and feature ratings across racial subgroups even when controlling for other demographic factors. Teachers who identified as African American or Black consistently rated items as slightly more important, on average, than teachers from any of the other race/ethnicity categories. Moreover, those who identified as male rated several data elements and features as less important than those who identified as female or non-binary. Our results indicated that certain needs, like the desire to align PD offerings with standards, were highly valued by certain subgroups and should be considered when creating the platform. Taken together, our findings highlight the importance of considering the perceptions, perspectives, and needs of various subgroups when designing a platform that is useful for all teachers.

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Abbreviations

The following abbreviations are used in this manuscript:

CS	Computer Science
PD	Professional Development
NSF	U.S. National Science Foundation
CEU	Continuing Education Unit
OR	Odds Ratio

Appendix A

Teachers wanted to see the following data in the platform from PD providers:

- Presenter/provider contact information.
- Organization offering the PD.

For each PD opportunity, teachers wanted the following data in the platform:

- Title of CS PD.
- Grade level targeted for the PD.
- Content taught (e.g., coding, fostering computational thinking, cybersecurity).
- Pedagogy covered (e.g., philosophy, project-based learning, culturally relevant, flipped classrooms, pair programming, differentiated instruction).
- Research-based evidence supporting the PD.
- Whether CS PD is intended for standalone courses or integrated lessons (and which subject CS is integrated into).
- Resource/Materials provided/Links to PD recordings offered during the PD.
- Tools needed to complete the PD.

More specific to the PD they participated in, teachers wanted the following data:

- Date and time of PD.
- Location (Online or in-person; if in-person, provide location).
- Training hours, points, and/or CEUs earned.
- Accessibility and Language options of the PD.
- Knowledge level required of participants.
- Format of PD (hands-on, research, workshop, learning lab).
- Frequency (one-time, continuing group, etc.).
- Cost for the PD to the teacher or school.
- Whether this course is a pre-req for another course or has additional support.
- Certificate earned.

Finally, one additional piece of data was requested by teachers:

- Notes section for teachers to take notes about the PD.

Teachers shared that they want the capability to search and list (in the platform and downloadable as PDF or .csv) by the following for each CS PD opportunity:

- CS PD data by grade level and subject matter.
- CS PD data by topic/pedagogy covered.
- CS PD data in chronological order of PD event.
- Certifications received for CS PD.
- Date and location of PD.
- CS PD taken by standards taught in the PD.
- Training hours, points, and/or CEUs.
- Format of CS PD (e.g., hands-on, research, workshop, learning lab, etc.).

Appendix A.1. Platform Training and Support

When asked about training and support for the platform, teachers requested the following:

- Hands-on session/in-person training.
- A kick-off live webinar.
- Walkthrough of how to use the app.
- Quick click through.
- Videos and text-based training built into the app.
- Data-security user education and training for individuals using the app.

Additionally, teachers want access to the following support:

- Getting started resources.
- Help page.
- FAQ guide.
- Tutorial videos supported by written instructions that can be searched in the moment.
- Manual with screenshots.
- “live” chat.
- Links to extended help.
- Multilingual support to make the platform accessible to a global audience, including non-English speakers.

Teachers also requested training for the platform that was specific to their job/position and a demonstration of the platform.

Appendix A.2. Features to Increase Usability and Usefulness

Teachers noted that the platform should meet required accessibility guidelines for federally funded websites (Web Content Accessibility Guidelines (WCAG) AA).

Teachers noted that a catalog of upcoming PD opportunities that is searchable across categories (grade level, location, subject area covered, etc.) with dates and links to register would increase the usability and usefulness of the platform. This includes:

- Annual conferences like CSTA annual conference.
- Presenter opportunities.
- Other CS PD opportunities.
- Opportunities that are a series (let participants know of the next series) (e.g., Google Education Level 1, Level 2, Trainer).
- Identify national and state-level PD.

Teachers also mentioned that the following features that would be useful:

- Add a badge system to reward teachers.
- Add a forum for teachers to share what they are learning in the PD.
- Include star rating/review section of PD.
- Identify if industry certification is available.
- Usage of QR codes for quick connecting to upcoming events.
- Inform teachers when their license is set to expire.
- Indicate if a teacher has met the minimum standards for license/certification renewal.
- Connect teacher certifications from different states.

Finally, teachers wanted the capability for teachers to add a professional growth plan so their PD can be mapped to their individualized plan.

Appendix A.3. Descriptive Statistics for All Items

Table A1. Descriptive statistics for feature items.

Feature	Mean (SD)
Catalog of searchable upcoming PD offerings	5.77 (1.30)
Place where users can contribute content, such as mini-courses, webinars, or a	5.42 (1.35)
Automatic reminder for teachers about their license expiration	5.36 (1.74)
CS PD offerings mapped to CSTA standards	5.32 (1.50)
Indication if industry certification is available upon completion of a CS PD	5.30 (1.62)
Forum for teachers to discuss what they are learning in the CS PD offering	5.28 (1.47)
Indication of whether you have met the minimum standards for	5.24 (1.73)
license/certification renewal	
Catalog of offerings for formal education (i.e., college coursework, relevant de	5.08 (1.66)
Book/resources exchange among teachers	4.91 (1.62)
Badging system to reward teachers for completing various CS PD	4.74 (1.84)
Place to enter professional growth goals that can be mapped to CS PD offerings	4.56 (1.76)
Link to invite a colleague not in the platform to join the CS PD	4.36 (1.69)
Place for teachers to take notes about a CS PD	4.24 (1.90)
QR codes for signing up for CS PD	4.18 (1.88)
Capability to enter data about non-CS PDs you have completed	4.09 (1.89)
QR codes for entering data about participation in a CS PD	3.97 (1.86)
Capability to see other teachers who signed up for a CS PD	3.89 (1.87)

Table A2. Descriptive statistics for data items.

Data Related Item	Mean (SD)
Subject/topics targeted by the CS PD offerings	6.05 (1.10)
Grade levels targeted by the CS PD offerings	6.00 (1.19)
Training hours, points, and/or CEU credits available to be earned by each CS PD	5.96 (1.25)
Date and location of each CS PD offering	5.91 (1.28)
List of all of your CS PD completed	5.85 (1.34)
Certifications received for each CS PD offering	5.84 (1.31)
Format of each CS PD offering (e.g., Hands-on, research, workshop, learning lab,	5.84 (1.39)
Total hours of CS PD completed	5.83 (1.38)
All CS PD certificates earned	5.74 (1.38)
Standards covered in each CS PD offering	5.71 (1.27)
CS conference participation and presentations	5.65 (1.33)
All CS PD taken that meet selected CSTA standards	5.56 (1.43)
All of your CS PD started	5.45 (1.56)

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