

Exploring Value, Utility, and Usability of a Computer Science Professional Development Platform (Fundamental)

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Abstract

Background. Currently, it is difficult to know how many teachers receive computer science (CS) professional development (PD), what type of CS PD they receive, and the quantity of CS PD engagement across the U.S. In order to track and report this data, the Computer Science (CS) Professional Development (PD) Passport Alliance has created a platform to provide the capability for tracking teacher-entered and PD provider-entered CS PD engagement.

Research Questions. Our research questions for this study were: *What reasons do teachers give about why they do not use the platform? What individual factors predict users' frequencies of logging into the platform, viewing the PD dashboard, and updating member profiles?*

Methodology. We used a cross-sectional survey design to determine participant usage of the platform and factors that predicted higher engagement with the platform. Teachers across the United States ($n = 518$) responded. Descriptive statistics and three separate ordinal logistic regression models were used to answer our two research questions.

Results. Results indicated that teachers generally had logged into the platform at least once, about half had viewed the PD dashboard, and about two-thirds updated their user profiles. The regression models indicated that PD attendance, years of CS teaching, frequency of submitting PD records, and method of keeping track of PD predicted platform engagement.

Implications. This platform has the potential to offer not only teacher CS PD participation numbers, but also to capture impacts on teachers' self-efficacy, mindset, and CS knowledge/pedagogical knowledge changes over time. Ensuring that teachers are engaged and using the platform will provide a richer data set that could be reported (in aggregate) to those that need it for making decisions about teacher PD.

How We Used AI. In this study, we used AI in shaping the survey questions (though

significant and multiple rounds of researcher edits were required). All other work was conducted by humans.

1 Introduction and Background

K-12 teachers often receive professional development (PD) throughout their careers to acquire new skills and improve their competencies [1, 2]. In fact, Continuing Education Units (CEUs) (which is typically used to measure the amount of PD) or similar are often required by their state to retain their professional credentials [3]. Tracking their PD is often also necessary to support licensing and personal reference [3] and is often tracked at the state or district level.

In addition to teachers tracking their own PD, other interested parties can benefit from understanding the PD that teachers take in aggregate form. This is particularly true of computer science (CS), a subfield of engineering, in which teacher preparation and professional learning is often distributed, professional isolation is common, and credential requirements substantially vary from state to state. State departments of education can benefit by understanding the type of CS PD that teachers are engaging in and how it may correlate to student outcomes as well as their department mandates and goals [1, 4]. School administrators can benefit by understanding how teachers within their buildings are keeping current with pedagogy, content knowledge, and tools. They may also want to create and implement plans to ensure that all teachers receive appropriate CS PD aligned with student and work to ensure that all teachers receive appropriate CS PD to support those needs. Funders, like the National Science Foundation, can benefit from understanding the breadth and depth of CS PD engagement across the nation as CS education continues to grow across K-12 schools. This data may also help shed light on the gaps in current CS PD offerings.

CS PD, unlike PD in other domains, is often not being tracked at the state/district level since CS is often not a required subject and/or credential standards aren't specific or aligned to CS education. However, user-friendly tools to centralize PD tracking can support evidence of teacher development and growth. The Computer Science Teachers Association (CSTA) has designed and launched a new platform intended to centralize and track CS teacher PD engagement for CSTA members.

To determine which features of this platform are likely to drive its use, we posed the following research question(s):

RQ1. What reasons do teachers give about why they do not use the platform?

RQ2. What individual factors predict users' frequencies of logging into the platform, viewing the PD dashboard, and updating member profiles?

Creating and releasing a platform to support organizational membership goals does not mean that the platform will be valued by all members. We ground our investigation in expectancy-value theory [5, 6]. Expectancy-value theory posits that one's propensity to engage a certain action is determined by expectations for success in that action (expectancies) and the value placed on pursuing that action (value). Notably, one will not pursue an action if either the expectancy or the value belief is zero.

Given the use of our platform is anticipated to be user friendly (i.e., all users should have high expectations for success), we focused our investigation on the value component, including

perceived usefulness—which is part of the Technology Acceptance Model [7]. Value is comprised of at least four subtypes[5, 6]:

- *Intrinsic value* pertains to the innate value one sees in an action. This is often described as closely aligned with intrinsic motivation/deep individual interest.
- *Attainment value* pertains to the personal "importance" one places on pursuing an action; relates to one's personal identity.
- *Utility value* pertains to one's perceptions of the usefulness of pursuing an action.
- Finally, *cost* refers to the perceived costs associated with pursuing an action (i.e., time spent, money/resources required, effort expended).

Our investigation focused mostly on utility value of the platform and its features.

2 Methodology

To answer our research questions, we created a cross-sectional survey based on earlier project work [8] and in conjunction with the project evaluators who also had previously collected related data. The survey collected data related to platform usage, the use of the PD features within the platform, profile updates, and demographic data, among other things. Only a portion of the results are shared in this report.

2.1 Participants

Since the platform was created for CSTA members, we recruited teachers who were also CSTA members through a direct email sent to them. The final analytic dataset includes 518 participants. We were interested in three main types of users:

- Those who consistently use the PD platform
- Those who used the platform only once or twice
- Those who never used the platform

Nearly half reported teaching high school grades, but all grades (including PreK) were also represented (see Table 1). Our sample was largely White, identified as Women, were between ages 40 and 59, and volunteered to teach CS (see Table 2). Participants reported an average of 17.67 years of teaching experience ($SD = 9.31$) and 8.75 years of computer science teaching experience ($SD = 7.96$).

Participants came from numerous geographic regions and locales (see Table 3). Nearly 7 in 10 respondents indicated they taught at a Title I school.

2.2 Measures

Beyond the general demographic items, we also collected teacher ratings of various items related to enhancing utility of the PD platform, and self-reported use of the platform. Specifically, the research team generated several items which teachers rated via a Likert scale (1 - Not at all to 7 - Very much so) regarding how much the given feature would increase their likelihood of using the platform. We also asked teachers to identify how often they used the platform via one item, with response options including: *Never*, *One time (logged in and never returned)*, *2-5 times*, *6-9 times*, *10 or more times*, and *I'm not sure*.

Table 1: Grades served by participants (select all that apply).

	<i>N</i>	%
PreK	33	6.37%
Kindergarten	87	16.80%
1st	96	18.53%
2nd	103	19.88%
3rd	114	22.01%
4th	118	22.78%
5th	120	23.17%
6th	125	24.13%
7th	131	25.29%
8th	132	25.48%
9th	232	44.79%
10th	243	46.91%
11th	244	47.10%
12th	240	46.33%

2.3 Analyses

We generated descriptive statistics to report participants' usage of and rationale for using the platform. Ordinal logistic regression was used to answer the two research questions. For each of the three models analyzed, the independent (predictor) variables were: how CS PD was tracked, whether they need to track their CS PD, the amount of PD sessions over the last three years, how often they submit PD records, who they submit records to, years of teaching experience (generally), and years of CS teaching experience.

In all models, we used the following reference categories for the categorical predictors: "None" for number of PD sessions attended, "Yes" for need to track PD records, "Never" for PD records submission frequency. Importantly, two variables (How CS PD was tracked and Who they need to submit PD records to) were "Choose all that apply". Therefore, each response option was dummy-coded as 0 (not selected) or 1 (selected). Thus, each of these response options were their own variables in the regression models, and the reference group was always "not selected".

The years of teaching (CS) variables were mean-centered to facilitate interpretation of odds ratios. Odds ratios and 95% confidence intervals were calculated to assess the magnitude and precision of associations between predictors and outcomes.

The dependent (outcome) variable for Model 1 was platform usage (i.e., number of times logged in), Model 2 was frequency of viewing the PD dashboard page (five categories ranging from "Never" to "10 or more times"), and Model 3 was profile updating behavior (i.e., *Never*, *Once or twice*, *Several times*).

3 Results

Descriptive statistics for the three dependent variables used in the ordinal logistic regression models are in Tables 8 (times logged into the platform), 11 (number of times participant viewed the PD dashboard), and 13 (number of times participants updated their profiles).

Table 2: Participant characteristics.

	<i>N</i>	%
Volunteered to teach CS	268	51.74%
Assigned with choice	157	30.31%
Required with no choice	58	11.20%
Missing	35	6.76%
Under 30	13	2.51%
30–39 years old	58	11.20%
40–49 years old	147	28.38%
50–59 years old	142	27.41%
60–69 years old	44	8.49%
70–79 years old	2	0.39%
Prefer not to say	11	2.12%
Missing	101	19.50%
Woman	270	52.12%
Man	137	26.45%
Non-binary	3	0.58%
Prefer not to say	8	1.54%
African-American/Black	61	11.78%
Asian (East)	10	1.93%
Asian (South)	7	1.35%
Asian (Southeast)	7	1.35%
Hispanic/Latino(a)	27	5.21%
Middle Eastern/North African	6	1.16%
Native American/Alaska Native	12	2.32%
Native Hawaiian/Pacific Islander	3	0.58%
White	293	56.56%
Prefer to self-describe	3	0.58%
Prefer not to say	16	3.09%

3.1 PD Participation and Tracking Needs

Questions related to PD participation, tracking, and records submission applied to general PD—not specifically CS PD. In Table 4, we see that almost all teacher reported partaking in some form of PD in the last three years. One in four noted they had participated in more than 25 sessions, with about one in five each indicated 1-5 sessions or 6-10 sessions.

Overall, the majority of participants (about 55%) were required to keep track of their PD and submit it to either their school, district, or state department of education (see Tables 5 and 6). The sample was split fairly evenly among the three main submission recipients and not being required to submit PD records at all.

Finally, the majority of participants who need to submit their records were required to do so once per year (see Table 7), though about one-quarter of the sample did not need to regularly submit records.

Table 3: School characteristics where participants taught.

	<i>N</i>	%
Title I School: Yes	348	67.18%
Title I School: No	102	19.69%
Title I School: Unsure	33	6.37%
Missing	35	6.76%
Northeast	146	28.19%
Midwest	98	18.92%
South	155	29.92%
West	83	16.02%
U.S. Territories	1	0.19%
Missing	35	6.76%
City	141	27.22%
Suburb	173	33.40%
Town	72	13.90%
Rural	112	21.62%

Table 4: PD Participation Over the Last Three Years.

	<i>N</i>	%
No PD	9	1.74%
1-5 sessions	104	20.08%
6-10 sessions	111	21.43%
11-15 sessions	66	12.74%
16-20 sessions	51	9.85%
21-25 sessions	29	5.60%
More than 25 sessions	113	21.81%

Note: This question was not specifically about CS PD.

Any type of PD was considered.

Table 5: Teachers Required to Keep Track of PD.

	<i>N</i>	%
Yes	144	55.02%
No	147	28.38%
Unsure or Missing	86	16.60%

Note: For analytic purposes, the *Unsure* response was considered missing data.

3.2 Platform Usage

From our descriptive statistics, only a small number of respondents (1 in 20) had never logged into the platform and roughly the same only logged in once and never returned (see Table 8).

We asked the 24 participants who had never logged in to select the reasons they had not yet done so. Table 9 shows these responses that were selected by at least one participant.

Table 6: Required To Submit To School, District, State.

	<i>N</i>	%
My school	147	28.38%
My district	170	32.82%
My state dept of ed	122	23.55%
Other	15	2.90%
Not required to submit	115	22.20%

Table 7: Frequency of required record submissions.

	<i>N</i>	%
Never	144	27.80%
Once a year	185	35.71%
Twice a year	18	3.47%
Once a quarter	10	1.93%
Once a month	9	1.74%
Other	106	20.46%

Table 8: Number of times participants logged into the platform.

	<i>N</i>	%
Never	24	4.63%
One time	39	7.53%
2–5 times	179	34.56%
6–9 times	84	16.22%
10 or more times	122	23.55%
I'm not sure or Missing	70	13.51%

Note. For analytic purposes, the *Unsure* response was considered missing data. One time log in indicates those that logged in and never returned.

Table 9: Reasons for Not Using the Platform

Reason	<i>N</i>	% Total
I have never heard of the platform before this survey	14	2.70
I did not know about the capability to keep track of completed PD	4	0.77
Other (please specify)	3	0.58
I keep track of my completed PD outside the platform	2	0.39
I do not take PD often	1	0.19
I am unsure of my login credentials for the platform	1	0.19
I do not have time to use the platform	1	0.19

We further asked the 39 participants who logged in once and never returned why they had not returned to the platform. Nearly half indicated that they weren't sure what to do after logging in and that they didn't have time to explore the platform further (see Table 10).

Table 10: Reasons for Logging Into the Platform Only Once

Reason	N	% Total
I did not have time to explore the platform further	22	4.25
I was not sure what to do after logging in	17	3.28
I did not find the platform's content or features useful	10	1.93
Logging in was not part of my regular routine or workflow	9	1.74
I did not receive reminders to return to the platform	7	1.35
My colleagues were not using the platform	7	1.35
The platform did not meet my expectations	4	0.77
The platform was difficult to navigate or confusing to use	3	0.58
The platform did not seem relevant to my work as a teacher	2	0.39
Other (please specify)	2	0.39
The platform was not accessible or did not work well on my device	1	0.19
I experienced technical problems (e.g., login issues, slow loading, bugs)	1	0.19
I did not feel included or represented in the platform's community	1	0.19
I was concerned about privacy or data use	0	0.00

The majority of participants self-reported they viewed the PD dashboard page between 1 and 5 times, though about 20% reported never viewing the page at all (see Table 11).

Table 11: Number of times participants viewed the PD dashboard page.

	N	%
Never	103	19.88%
One time	120	23.17%
2–5 times	141	27.22%
6–9 times	12	2.32%
10 or more times	13	2.51%
NA or Unsure*	129	24.90%

**Unsure* responses were considered missing for all analyses

For those that indicated that they had never viewed the PD dashboard page, their reasons varied. Nearly 17% ($n = 86$) of respondents did not know the platform existed. Other cited reasons are detailed in Table 12.

Finally, Table 13 shows the number of times participants reported updating their profiles on the platform. Notably, over half the sample had updated their profiles at least once.

3.3 PD Participation and Platform Usage

We conducted an ordinal logistic regression analysis to examine the relationship between PD participation and platform usage. We treated the number of PD sessions attended as an ordinal variable, with "None" serving as the reference group. Years of teaching experience was mean-centered to facilitate interpretation of odds ratios.

Table 12: Reasons for Not Using the CS Professional Development Platform

Reason	N	% Total
I was not aware that the platform existed	86	16.60
Other (please specify)	22	4.25
Logging my CEUs is not part of my normal workflow	12	2.32
I was not sure how to use the platform	11	2.12
Logging CS-related CEUs feels redundant since my school/district already tracks them	8	1.54
I do not have time to work through uploading my CEUs	8	1.54
I have not been reminded or encouraged to log CEUs	8	1.54
I do not see the benefit of using the Professional Development page	8	1.54
It does not integrate with other systems I use to track CEUs	5	0.97
Logging CEUs related to CS only leaves me without a place to log non-CS CEUs	4	0.77
Logging CS-related CEUs feels redundant because I already track them elsewhere	4	0.77
Logging my CEUs would take too much time	3	0.58
I am unsure how my data are stored or protected	3	0.58
I plan to log CEUs later but often forget	2	0.39
The platform is difficult or confusing to use	1	0.19
I experienced technical problems (e.g., login issues, slow loading, mobile problems)	0	0.00
I am concerned about who can see my information	0	0.00
I tried to use it but found the instructions unclear	0	0.00

Table 13: Number of times participants updated their profiles.

	N	%
Never	33	6.37%
Once or twice	258	49.81%
Several times	70	13.51%
NA or Unsure*	157	30.31%

*Unsure responses were considered missing for all analyses

Table 14: Significant Predictors of Platform Logins

Term	OR	Z (p-value)	95% CI of OR
Attended 21-25 PD sessions	10.957	3.059 (0.002)	2.363 - 50.812
Attended More than 25 PD sessions	7.141	2.881 (0.004)	1.875 - 27.200
Attended 11-15 PD sessions	5.370	2.423 (0.015)	1.379 - 20.916
Attended 16-20 PD sessions	4.043	1.996 (0.046)	1.026 - 15.932
Attended 1-5 PD sessions	3.913	2.022 (0.043)	1.043 - 14.687
Years of CS Teaching	1.030	2.080 (0.037)	1.002 - 1.058
Submit records at <i>another</i> frequency	0.429	-2.299 (0.022)	0.208 - 0.883

The analysis revealed that PD participation in the last three years significantly predicted platform

usage (see Table 14). Specifically, those who attended 21-25 sessions were nearly 11 times more likely to have logged in the same number of times or more than those who attended no PD. In fact, teachers attending at least one PD session were at least 4 times more likely to have logged in the same number of times or more than those who attended no PD. Years of teaching CS was also a significant predictor. For each additional year of CS teaching experience, teachers' odds of using the platform at the next-highest level (e.g., moving from using *one time* to using *2-5 times*) increased by approximately 3%.

Interestingly, the frequency of PD record submission (at the *Other* frequency) showed a negative relationship with platform usage. Teachers who indicated that they were required to submit records at a different frequency than listed in the question had significantly lower odds of increased platform usage compared to teachers who never submit records, representing an approximately 57% reduction in odds.

3.4 Times Viewed The PD Dashboard

We conducted an ordinal logistic regression analysis to examine factors that predicted the number of times a user viewed the PD Dashboard on the platform, measured on a five-point scale ranging from "Never" to "10 or more times."

The only significant predictor of viewing the PD dashboard was the frequency with which teachers indicated that they had to submit PD records (i.e., never, once a month, once a quarter, once a year). Teachers required to submit records at *another* frequency had significantly lower odds of reporting greater platform engagement compared to teachers who did not have to submit records at *another* frequency ($OR = 0.433$, $Z = -2.08$, $p = .037$, $95\%CI[0.197, 0.951]$). Specifically, these participants' odds of viewing the dashboard at the same or higher frequency were about 57% lower than those who did not submit records at *another* frequency.

3.5 Updating Profiles

Teachers who indicated they track their PD in physical folders were much less likely to update their member profiles at comparable rates (or higher) than those who did not track their PD in this way ($OR = 0.518$, $Z = -2.001$, $p = .045$, $95\%CI[0.272, 0.987]$). Interestingly, this was the only statistically significant predictor among our set of independent variables.

4 Discussion

The platform itself has multiple features, including the capability for teachers to track their PD. Most of the teachers who took the survey had logged into the platform at least once, with the majority noting they had logged in between one and five times. The reasons for not using the system or only logging in once is directly related to expectancy-value [5, 6]. For participants who had never logged into the platform ($n = 24$), most were not aware that the platform existed. For participants ($n = 39$) who had only logged in once and never returned, most ($n = 22$) did not have enough time to explore it further (*cost* component of Expectancy-Value theory), weren't sure what to do after logging in (*utility value* component), or didn't find the platform's content or features useful (*utility value* component).

Two of those are directly associated with perceived *utility* of the system and, while not generalizable given the few responses, could be indicative of the platform not fully meeting its goals. The third cited reason, a lack of time, is also more related to *cost*; if a user thought the

platform and its features would save them time or abate other costs, then they may take the time to engage with the system [7].

Most of the teachers who took the survey had used the PD features within the platform to a lesser extent. About 85% of the participants who had not used the feature noted that they weren't aware the feature existed—an issue that may be addressable through an awareness campaign.

We also found that moderate and high PD participation was significantly and positively predictive of platform usage. Years of CS teaching was also a significant and positive predictor. However, teachers who were required to submit records at *another* frequency had reduced platform usage relative to those with no such reporting requirements. It is important to note, however, that very few participants ($n = 9$) indicated they had *No PD* within the last three years (see Table 4). This extremely small cell size likely influenced the confidence intervals reported in Table 14, which are quite wide (indicating low confidence in the point estimate of the odds ratio). Therefore, these results must be interpreted cautiously.

Finally, results from sections 3.4 and 3.5 showed that viewing the PD dashboard and updating member profiles were largely not associated with any of the predictors we included in our models. Although two of the dummy-coded variables did emerge as significant predictors, interpreting their practical significance is challenging. It remains unclear, for example, why users who keep their PD records in physical folders are more likely to update their profiles with higher frequencies. Such a relationship is not clearly explained by expectancy-value theory.

4.1 Limitations

All measures were self-reported, which introduces potential for recall bias (especially for frequency counts), social desirability bias, and measurement error. Teachers may not accurately recall exactly how many PD sessions they attended or how often they accessed the platform.

The confidence intervals for many predictors are very wide, indicating substantial uncertainty in the effect size estimates. As noted earlier in the Discussion, this is likely due to relatively small sample sizes within certain categories (such as those with "No PD" in the last three years), reducing the precision of the findings.

5 Conclusions

The CSTA membership platform is new and understanding whether or not it is meeting teachers' needs is critical for its adoption. Given the results, it is likely that while the platform itself may be beneficial to teachers, the PD dashboard tracking feature may not be as needed by those who never are required to track their PD. But, since a majority of teachers are required to do so, it's important to understand whether the feature is supporting what they want out of the system. For example, in one of our earlier inquiries we found that teachers want to be able to see a catalog of upcoming PDs and sign up for them within the system [8]. Understandably, this would be a powerful feature that would likely increase usage of the platform.

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