Credible for whom?
Middle/high school science teachers and their induction programs

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What might it mean for a new teacher support program (often referred to as an induction program) to be "credible"? As induction programs are created, designers may attempt to incorporate features and goals considered important from a variety of perspectives - teacher development, teacher quality, adult learning, supportive workplace environments, subject matter reforms, or student achievement, to name just a few. Those involved in providing new teacher support services may well keep new teachers "in mind" as they construct and implement inductions programs. Yet, program evaluations tend to take the program's perspective – are teachers getting what the program is designed to deliver? As induction programs become part of the educational "system," they are in danger of having multiple (and sometimes conflicting) expectations heaped on them – teacher recruitment, retention, certification, professional development, and curricular or teaching reforms. The perspective of the individual teacher may be missed – what makes an induction program credible from a teacher's standpoint? Do new teachers get what they want from the programs in which they participate?

This paper explores formal induction programs from the perspective of middle and high school science teachers in the Bay area. Survey data collected from a small group of new science teachers in 2002 and anecdotal accounts from four years of case study work with new science teachers are used to structure a three-part discussion of science teachers and induction

program credibility. After an overview of the larger study from which the data is drawn and the survey methods, the first section of the paper addresses what teachers want from their induction programs and the opportunities teachers report are made available to them through their induction programs. In the next section, the data is examined further to make conjectures about the work teachers perceive they are being inducted into and program "credibility" – the extent to which the induction programs included in the survey support teachers in that work. In the final section, several concerns are raised about both teacher and program perceptions of the work teachers are being inducted into.

Overview

The survey from which this data is drawn is part of a 5-year NSF-funded summative evaluation of an induction program offered in the Bay area by the Exploratorium, a museum of science, art, and perception in San Francisco. The museum promotes scientific inquiry through interactive exhibits that allow museum visitors to investigate scientific principles underlying natural phenomenon like human vision or hearing. Since 1984, Exploratorium staff members have offered workshops and a summer Teachers Institute (TI) for middle and high school science teachers in the San Francisco Bay area. In 1998, in response to an increasing enrollment of new teachers in TI, the staff designed a support program especially for new science teachers – the

Exploratorium New Teacher Induction Program (TIP). Mentors and coaches for TIP are selected from TI/TIP staff and TI alumni.

During the academic year, TIP offers participants support group meetings, content and pedagogy workshops (called Saturday workshops), and classroom coaching and mentoring assistance. During the summer between participants' first and second year in the program, TIP participants join TI participants in a 4-week Summer Institute. One of the primary goals of both TI and TIP is to provide participating teachers with "a rich mix of learning experiences designed to help them infuse their teaching with hands-on activities, inquiry, and strong science content" (TI/TIP brochure, p. 1).

Unlike mandated induction programs, teachers apply to TIP and receive stipends for their participation. In the early years of the program almost all teachers who applied were accepted. However, over the past few years, the number of applicants exceeds program capacity. Consequently, some teachers who apply now have to be "wait-listed" or are not accepted into the program. Once teachers are accepted into TIP, they are expected to meet a minimum number of requirements for workshops, mentoring groups, and the summer institute. However, there are no "penalties" for not completing requirements other than not being included in future TI activities. TIP operates on what staff calls a "menu-driven" system. Teachers are required to participate in certain components of the program but are also able to choose what they want within that structure. For example, new teachers are expected to attend

four Saturday workshops per semester but are free to select workshops based on their interest, scheduling, or location.

A number of TIP participants also participate in other induction programs. These include district-sponsored induction and Teach for America. The district-sponsored programs are the Beginning Teacher Support and Assessment program (BTSA) and Peer Assessment and Review (PAR). Teachers are assigned to a district program based on their credential status and their school status as a "failing" or "non-failing" school. Teachers and their support providers are expected to document completion of program requirements in order to move from preliminary to professional credentialing status. Although a common set of elements and tasks are technically required, district programs vary in what is available to, and expected from, new teachers. All involve some form of mentoring or coaching. However, depending on the human resources available, mentors or coaches may or may not be experienced science teachers. Both BTSA and PAR have a list of formative assessment requirements for new teachers to complete with their mentors/coaches. PAR also includes a "formal evaluation" component. The programs also generally offer new teacher workshops on topics like classroom management.

Teach for America (TFA) also provides new teacher support in the Bay area. TFA teachers are college graduates, generally from prestigious institutions, who agree to teach in districts and subject areas experiencing teacher shortages. Teachers must apply to TFA and go through a careful screening

process before being accepted. Once accepted, teachers attend a 6-week summer induction experience into teaching before being assigned to classrooms. During their first few years of teaching, TFA teachers meet together in support groups, receive mentoring from experienced teachers, and guidance from TFA staff.

This complex of individuals, teaching situations, and induction programs in the Bay area makes it challenging to determine the impact TIP has on new science teachers. Consequently, the TIP program evaluation involves a mixed-methods design to help map the opportunities available to new teachers and understand what teachers learn from those opportunities. Data collection for the evaluation includes interviews (with program staff, district/school personnel, and teachers), observations of TIP program components, individual teacher case studies (TIP and non-TIP) and a survey of new science teachers in the Bay area. This paper primarily draws on portions of the survey data collected at the end of the 2001-2002 school year.

Survey methods

Survey questionnaire and population

The survey data was collected using a mailed questionnaire that was developed in 2001. The questionnaire - the California Science Teachers Induction Survey (CSTIQ) - asks teachers to: (1) describe and evaluate new teacher programs in which they have participated; (2) assess their confidence

in teaching; (3) describe their current teaching situation and practices; and (4) provide information about their educational background, as well as information on their teaching experience, credential status, and personal demographics.

The 2002 survey was the first administration of CSTIQ. After considerable difficulty obtaining an accurate list of new science teachers, a small population of 119 middle and high school science teachers with less than four years experience in three Bay area school districts was identified. CSTIQ was mailed to all 119 teachers in late May 2002. 32% percent of the population surveyed – 38 teachers[1] - completed the survey questionnaire. Of the 38 teachers, 35 participated in at least one formal induction program. 19 of the teachers participated in TIP. 25 of the teachers participated in district -sponsored programs (PAR and/or BTSA) and 3 of the teachers participated in other programs (e.g. Teach for America). 19 of the teachers participated in more than one induction program.

Questionnaire items used in the analysis

Two sets of items from the 2002 CSTIQ survey supplied data for analyzing what teachers want and what teachers perceive they get from their formal induction programs. The first set of items addressed program features – the opportunities programs offer their participants. Respondents circled "yes" or

[1] We conducted preliminary analyses and asked district personnel to review respondent demographics to detect selection bias and felt reasonably assured that the group of respondents represented "typical" types and frequency of new science teachers working in the districts we surveyed.

"no" to indicate whether or not their induction program(s) offered the 21 features included on the questionnaire. [2] *The list of features, drawn from the induction literature, included a range of possible program components (e.g. stipends, seminars, reduced teaching load), structures (e.g. mentoring, peer collaboration), and types of support (e.g. generic or subject-specific). In the following item, teachers indicated the three features (selected from the list) they considered most important in a program for new teachers and the two features they considered least important in a professional development program for new teachers.*

The second set of items addressed program goals – the knowledge and skills programs emphasize. Respondents used a 1 to 5 Likert scale to rate the extent to which their induction program(s) helped them develop particular knowledge and skills to improve their teaching. The list of knowledge and skills included 20 possible goals drawn from the literature on beginning teaching and, in particular, middle and high school science teaching. The goals included items addressing subject matter knowledge and teaching (e.g. know the concepts, knowledge, and skills of the subject matter you teach), generic knowledge and skill for teaching (e.g. choose different teaching strategies for different instructional purposes), generic work with students (e.g. set appropriately challenging learning expectations for students) and science-

[2] Teachers could add a feature that wasn't listed if they chose to do so but very few teachers did so. The few additions did not alter the findings and are not included here.

specific work with students (e.g. develop science lessons and units that motivate students to learn).

Subscales for analysis

In order to facilitate the analysis of the data, subscales (referred to in the discussion as categories) were developed for program features and for program goals. Based on the content of the item, the 21 features included on the questionnaire were grouped into five subscales for analysis:

Collegiality (six items) – opportunities for working with other teachers, administrators, or staff

Compensation (five items) – opportunities for additional money, time, or convenience of program delivery

Generic support (four items) – opportunities for pedagogical support

Science-specific support (five items) – opportunities for support specifically for teaching science

Seminar-type structures for learning (two items) – opportunities to participate in seminars, classes, study groups, or institutes

(see Appendix A1 for a list of items included in the features subscales).

The 20 goals were also grouped into four subscales (categories) based on the content of the item:

Generic curriculum and instruction – non-subject specific knowledge and skills

Science-specific curriculum and instruction – subject specific knowledge and skills

Generic work with students – ways of working with students to improve their knowledge and skills

Science-focused work with students - ways of working with students to improve their science knowledge and skills

(see Appendix A2 for a list of items goals included in the goals subscales).

Methods for analysis

To determine what respondents considered most and least important for new teacher support programs, the number of teachers reporting at least one feature or goal in each category was recorded. The data was then disaggregated into two groups – respondents who participated in TIP and respondents who did not participate in TIP. TIP is of particular interest as a unique induction program for several reasons – it is not part of the school system, it is offered by an informal learning institution that is rich in science resources, and it offers an array of opportunities for science-specific support.

Determining teachers' perceptions of the opportunities available to them through their programs was complicated by the fact that some teachers were in more than one program. In order to get an "overall" picture for features (binary scale), teachers were assigned to a category if the combination of programs in which they participated provided a specified number of the features in the category[3] ("across programs" on Table 2). The data was then disaggregated into non-TIP programs and TIP. For goals, an "overall" mean rating (mean "across programs") was not calculated because combining program means for the subscales would not provide any useful information. For example, if a teacher has a mean rating of "4" for TIP and a "3" for a non-TIP program on the *science curriculum and instruction subscale*, their opportunities *for science curriculum and instruction* across their programs would still be "4" and not reduced to 3.4 overall. Therefore, only means ratings by group (TIP programs and non-TIP programs) are reported for each subscale of goals.

Statistical tests used to determine significance included the one-sample test of proportion and two-sample test for equality of proportion for the binary data. A two-sample t-test for means was used to compare means between groups that were not overlapping. A two-sample paired t-test of means was used for overlapping groups. In order to facilitate discussion of the findings with

[3] A feature was "counted" as being present in a program if a teacher indicated the program provided a minimum number of items from the category. The minimum number was set based on what seemed reasonable for a program to be able to provide as well as review of the program descriptions. The minimum items required to characterize a program as having a particular feature are listed in Table 2.

a minimum of technical language, *majority of teachers, most teachers, few teachers, more likely, or less likely* will be used to refer to a proportion of respondents that is statistically significant ($p < .05$).

We now turn to the discussion of the findings themselves, looking first at the features of induction programs followed by the goals. For each, I present and briefly discuss what teachers (as a whole group and as TIP and non-TIP subgroups) consider important in a professional development program for new teachers and the opportunities they perceive are available to them through their induction programs.

What teachers want and what they report they get from their induction programs

Features – what teachers want from their induction programs

Table 1 shows the number of teachers who selected at least one item from the *features* subscale as "most important" and "least important" for a new teacher professional development program. Of particular interest are the categories a majority of teachers selected. In general, teachers considered opportunities for *collegiality* and *science-specific support* most important and *compensation* least important. Looking first at *collegiality*, teachers' choice of this category indicates they value opportunities to work with others in their induction programs. The need for new teachers to connect with others is not

surprising, especially given studies that frequently report that teachers experience a sense of isolation from colleagues in their work. Although not included in Table 1, a closer examination of the actual items selected by teachers in this category shows that teachers include mentors, coaches, other new teachers, and experienced teachers among those they would like to include as part of their professional development. There was only one item from the *collegiality* category that was not selected by any teacher as "most important" – that item read "provides regular supportive communication with principal, other administrator, department chair, or staff." However, little can be said about the significance of this finding. There are just too many possible reasons for this omission ranging from issues of authority to judgments of expertise to offer any tenable speculation here about why teachers did not select this item.

The other category of features most teachers selected was science-specific support. Teachers wanted their induction programs to include support for things like learning more about subject matter and teaching techniques specific to subject matter. Some also wanted the program to provide resources for teaching science. The only item few teachers selected from the science-specific support category was the item "provides assistance from science content experts or specialists" ($p < .05$). Again, it is too difficult to sort through the many reasons teachers might not select this item with any certainty. However, our work with case study teachers does suggest that teachers tend to

hold the advice of other teachers, or, as they sometimes put it, "those who are working in the trenches," in the highest regard. Science content specialists may not qualify as "trench workers."

Not only did the teachers prefer subject-specific support, they also wanted subject-specific support more than they wanted generic-support. Teachers were much more interested in opportunities for opportunities related to science and science teaching in their programs than opportunities for generic support with things like general teaching techniques or feedback from program staff on their teaching ($Z= 3.11$, $p < .01$). The strong preference for subject-specific support expressed by the survey respondents runs against the notion often found in literature about new teachers that they are preoccupied with issues of classroom management or teaching techniques detached from subject matter. Further discussion of the possible significance of teachers' preference for science-specific support will be taken up in the next section of the paper.

Turning to subgroup differences with regards to the importance of program features, most TIP teachers also selected *collegiality* and *science-specific support* as opportunities they wanted in new teacher support programs. This situation raised the possibility that the TIP subgroup is primarily contributing to the overall respondent results. However, this is not the case. Teachers who did not participate in TIP were just as likely as TIP respondents to select features of

collegiality and science specific support (for collegiality Z= -0.32, p > .05; for science-specific support Z = -1.80, p > .05).

Table 1

Number of teachers selecting features they considered most/least important in a professional development program for new teachers

	Total respondents[a]		Non TIP respondents[b]		TIP respondents[c]	
Feature Subscale	Least important	Most important	Least important	Most important	Least important	Most important
Collegiality	10	25**	5	11	5	14*
Compensation	12*	20	8	11	15**	9
Generic support	9	10	4	6	5	4
Science-specific support	5	24*	2	8	3	15**
Seminar-type structures for learning	4	7	3	4	1	3

*p< .05. **p<.01.

Note. For most important, respondents selected 3 items from a list of 21 features. For least important, respondents selected 2 items from a list of 21 features. The subscale was counted as most important if a respondent selected any one subscale feature as most important in a professional development program for new teachers in CSTIQ item 3a. The subscale was counted as least important if a respondent selected any one subscale feature as least important in a professional development program for new teachers in CSTIQ item 3b. CSTIQ items comprising the features subscales can be found in Appendix A. Statistical significance determined using a one sample test for a proportion.

[a]n = 35. [b]n = 16 [c]n = 19

The only category of features most teachers chose as least important was *compensation*. In terms of group differences, compensation was also least important to the TIP group. Since TIP participants do receive stipends and, therefore may not feel a press for compensation, a comparison between groups was made to test for self-selection. However, there was no significant difference between the TIP and non-TIP groups ($Z = .61$, $p > .05$).

I do find the low importance rating of *compensation* rather surprising, especially since this category included reduced number of preparations and teaching course load. In our case study work, we find new teachers often talk about how overwhelmed they are with their workload, especially during their first year of teaching. Further speculation about this puzzling result, especially its relationship to the status of teaching as a profession marked by limited financial gain will be offered in the final section of the paper. With teachers' preferences in mind, we now consider what features teacher report they actually find in their induction programs.

Features – what teachers get in their induction programs

Table 2 shows how many teachers reported the program in which they participated, in general, provided *collegiality*, *compensation*, *generic support*, *science-specific support*, and *seminar-type structures for learning*. Overall, a majority of teachers reported the combination of programs in which they

participated provided opportunities for *collegiality, seminar-type structures for learning, and science-specific support.* I will discuss each in turn with respect to program similarities and differences by looking at the significant items selected within each category.

In the category collegiality, regardless of program, teachers were most likely to be assigned a mentor or coach ($p < .001$). Another common feature across programs was peer coaching ($p < .01$). These results are not surprising. Mentoring (and/or coaching) is often considered the "mainstay" of induction programs (Feiman-Nemser, S.,Schwille, S,Carver,C., &Yusko,B, 1999). The programs included in this survey are no exception – all of the program descriptions include some form of coaching or mentoring. On the other end of the spectrum, programs are unlikely to provide "regular supportive communication with principal, other administrator, department chair, or staff" ($p < .05$ non–TIP; $p < .001$ TIP). One possible explanation for this finding may be that communication at the local school administrative level is considered to be outside the control of districts and non-school based programs like TIP.

There were several notable differences in the kinds of opportunities for collegiality provided between TIP and other programs. Almost all TIP respondents indicated they engaged in collaborative work with both new teachers and experienced teachers ($p < .001$). Teachers in programs other than TIP reported fewer opportunities for these kinds of collaborations and, when they did occur, the working groups tended to be more variable. Respondents

reported some non-TIP programs included joint work solely with new teachers, others only with experienced teachers, and a few offered collaborations with both groups. Programs also differed with regard to peer coaching providers. Although all programs offered peer coaching, the majority of TIP respondents received coaching from teachers in other schools ($p < .05$) or program staff.

Table 2

Number of teachers reporting the presence of a majority of subscale features in programs in which they participate

	Across programs[a]	Non TIP programs[b]	TIP program[c]
Feature Subscale			
Collegiality	26**	17	12*
Compensation[d]	8	4	5
Generic support	22	17	10
Science-specific support	24*	9	19****
Seminar-type structures for learning	27**	17	17***

*p< .05. **p<.01. ***p<.001. ****p<.0001

Note. The subscale was counted as being present in a program if a respondent indicated "yes" in item 2 for the majority of the features in the subscale (at least three features from collegiality; three from compensation; three from generic support; four from science-specific support, and one from seminar-type structures for learning). CSTIQ items comprising the features subscales can be found in Appendix A. Statistical significance determined with a one sample Z-test of a proportion.

[a]n = 35. [b]n = 28. [c]n = 19.

[d] The compensation subscale includes several items that are only under the control of districts (e.g. "provides a reduced teaching

schedule"). Consequently, the subscale is biased against a non-district sponsored program like the Exploratorium new teacher program.

Non-TIP programs were less predictable. In some cases, peer coaches were same-school colleagues. In other cases, they were teachers from other schools or program staff. A third difference between programs was support for release time to observe other teachers. None of the TIP respondents reported receiving release time while non-TIP programs provided release time to over half of their participants.

As with mentoring, these results mirror program descriptions. However, they also reflect the ways in which programs (and the resulting program descriptions) are dependent on the context of the program providers. An "out-of school" provider like TIP may have difficulty offering certain opportunities (like release time to observe other teachers) because a teacher's workday falls under the jurisdiction of the school district. Undoubtedly the bureaucratic pressures school districts face also help shape what an induction program offers. Districts have to juggle scheduling demands, union contracts, and hiring practices that may interfere with opportunities a program can provide for things like joint work with colleagues. Staffing may vary considerably across schools. For example, in one school the induction program may be able to offer opportunities for new teachers to work with staff members, other new teachers, and experienced teachers alike that may not be possible in another school. A program like TIP that is less dependent on district or individual school capacity

may be better situated to provide a consistent array of partners (e.g. new teachers, experienced teachers) with whom new teachers work.

The second feature a majority of respondents were likely to find in their program was *seminar-type structures for learning*. These included workshops, seminars, institutes, and classes. Again, this finding is consistent with published program descriptions. For example, in one district's PAR program, new teachers meet monthly to learn about topics like classroom management or modification for students with special needs. TIP teachers are also offered workshops throughout the academic year as well as a summer Institute.

Although both TIP and non-TIP programs provided opportunities for *collegiality* and *seminar-type structures for learning*, they differed markedly when it came to the kind of support those opportunities provided. Although most teachers indicated the combination of programs in which they participated provided support for science and science teaching, a comparison between TIP and non-TIP programs showed significant differences between the programs in this regard ($p < .001$). In other words, the results of the TIP respondents in this category disproportionately drove the overall finding that *science-specific support* was available to most teachers. All of the TIP teachers indicated their program offered opportunities for *science-specific support*. Furthermore, every TIP respondent responded affirmatively on all four of the items in the *science-specific support* category. In contrast, a majority of

respondents from non-TIP programs reported they did not receive opportunities for *subject specific support* in their program(s)($p < .01$).

As proposed in the previous discussion of TIP and non-TIP subgroup differences in *collegiality*, it is likely that context and capacity are also at the core of the subgroup differences in *science-specific support*. Many of the districts we work with do not have enough experienced science teachers to assign as mentors or coaches. Some new teachers may be assigned their department chair or another science teacher as their mentor while others have a district coach who is an experienced teacher in another field. On the other hand, all the TIP mentors, coaches, and staff have experience teaching science in school classrooms. While TIP targets science teaching with their induction program, districts may provide professional development for science teachers apart from induction, through district-level science teacher workshops, for example, rather than under the auspices of an induction program. Finally, the Exploratorium is rich in science resources, with exhibits, content experts, and teaching materials few districts would be able to match.

In brief, teachers wanted opportunities for collegiality and science-specific support. While they are likely to find opportunities for collegiality within their programs, only TIP participants are ensure opportunities for science-specific support. As previously noted, a deeper discussion of the match between the features teachers consider important for new teacher programs and the features they believe they actually find in their programs will be taken up in the

next section of the paper. In order to add to that discussion, we now turn our attention to the findings about program goals.

Features like *collegiality*, are only part of an induction program's story. The content or curriculum of induction is equally important to consider. There are many things, for example, that might be emphasized in a workshop or a mentoring experience. What knowledge and skills do teachers believe are most and least important for induction programs to emphasize? The discussion of program goals will follow a similar structure to that used for examining program features, with one exception. While results for the entire group of respondents are reported for what teachers considered important in their program(s), they could not be calculated for what is available in programs. As will be explained momentarily, the measurement scale used to rate programs and the fact that some teachers are in more than one program lends itself only to an analysis of subgroup differences.

Goals – what teachers want from their induction programs

As noted in the methods section of the paper, there are four categories of goals that group the knowledge and skills teachers have opportunities to learn in their induction programs: *science-specific curriculum and instruction*, generic curriculum and instruction, *science-specific ways of working with students*, and *generic ways of working with students*. Table 3 shows the number of teachers selecting at least one goal from the category as most important or least

important.[4] The only category selected by a majority of respondents as "most important" in a professional development program for new teachers was *science-specific curriculum and instruction.* This was also the only category chosen as "most important" by most TIP teachers and by non-TIP program respondents. Teachers wanted their induction programs to offer opportunities to learn more about subject matter, how to find/create resources for use in science teaching, how to use the state science curriculum framework to plan instruction, and how to maintain an orderly, purposeful classroom that promotes science learning. The set of knowledge and skills teachers wanted their new teacher programs to support certainly makes sense. Deciding what science topics to teach, how to find and create resources for teaching science, and how to structure their classrooms for science teaching make up a good portion of what our case study teachers wrestle with in their daily work.

Oddly, a significant proportion of teachers also selected *science curriculum and instruction* as "least important." However, the items selected as most important and least important within this category were significantly different. Table 3a shows those differences. For most important, three items were chosen most often - "know the concepts, knowledge, and skills of the subject matter you teach," "know how to find/create resources for use in science teaching, and how to "maintain an orderly, purposeful science learning

[4] Only one item – "evaluate science curriculum materials" - was not selected by any teacher as a "most important" program goal.

environment." For least important, two goals – "evaluate science curriculum materials" and "evaluate and use technology to enhance science teaching/learning" were selected most often.

As just mentioned, it is plausible that the items teachers selected as most important reflected the press of their daily work. This explanation might also be extended to the items they selected as least important. In other words, those items did not address the daily demands teachers faced in their work. This explanation does seem a good fit for the item dealing with technology. Many of the case study teachers we work with have very little technology available to them, especially for use with students. The "least important" rating of this item (and the fact that no teacher selected it as "most important") is more difficult to understand. Perhaps new teachers tend to understand their primary responsibility as science curriculum *implementation*, leaving evaluation to district curriculum committees, textbook developers, or science curriculum specialists.

It does seem rather striking that a single category – *science-specific curriculum and instruction* – was selected as "most important" for several reasons. First, it suggests the possibility of a "single-mindedness" or consensus of teachers who responded to the survey about what their new teacher programs(s) should help them do. It also suggests another kind of "single-mindedness" related to the goals attended to. Most teachers did not select either of the categories (generic or science-specific) pertaining to students.

Furthermore, the "status" of *science-specific curriculum and instruction* as the only category most teachers selected makes me wonder about how these teachers' positions as secondary science teachers mediate their understanding of the work of science teaching. Further speculation about these findings as well as their implications related to induction will continue in the final section of the paper after first attending to what teachers perceive they actually learn from their induction programs.

Table 3

Number of teachers selecting goals they considered most/least important in a professional development program for new teachers

	Total respondents[a]		Non TIP respondents[b]		TIP respondents[c]	
Goals Subscale	Least important	Most important	Least important	Most important	Least important	Most important
Generic curriculum and instruction	3	11	2	3	1	8
Science-specific curriculum and instruction	21*	30****	10	12*	11	18****
Generic work with students	13	20	5	11	8	9
Science-specific work with students	10	20	4	10	6	10

*p< .05. **p<.01. ***p<.001. ****p<.0001

Note. For most important, respondents selected 3 items from a list of 20 goals. For least important, respondents selected 2 items from a list of 20 goals. The subscale was counted as most important if a respondent selected any one subscale feature as most important in a professional development program for new teachers in CSTIQ item 5a The subscale was counted as least important if a respondent selected any one subscale feature as least important in a professional development program for new teachers in CSTIQ item 5b. CSTIQ items comprising the goals subscales can be found in Appendix A. Statistical significance determined using a one sample test for a proportion.
[a]n = 35. [b]n = 16 [c]n = 19

Table A3

Differences between goals selected as most and least important within the subscale science curriculum and instruction

Subscale		CSTIQ item
Most important	Least important	
10**	1	Item 4a. Know the concepts, knowledge, and skills of the subject matter you teach (e.g. science, math).
2	4	Item 4b. Use the state's curriculum frameworks and performance standards to plan instruction.
0	6*	Item 4c. Evaluate science curriculum materials
5*	0	Item 4d. Use teaching strategies that promote student inquiry.
16**	3	Item 4h. Know how to find/create resources for use in science teaching.
1	9**	Item 4i. Evaluate and use technology to enhance science teaching/learning.
12**	2	Item 4j. Maintain an orderly, purposeful science learning environment.

*p < .05. **p<.01

Note: Significance determined by a two-sample test of equality of proportions. n = 35.

Goals – what teachers get from their induction programs

The final set of items analyzed for this paper used a 1 to 5 Likert scale for evaluating what teachers perceived they learned from their programs. Respondents rated the extent to which the programs in which they participated helped them develop the knowledge and skills included for each of the four goal categories – *generic curriculum and instruction*, *science-specific curriculum and instruction*, *generic work with students*, and *science-specific work with students*. Table 4 shows the means for each category for TIP and non-TIP programs.

For the TIP program, three categories had a mean rating greater than or equal to three (the "adequate" rating on the Likert scale) – *science curriculum and instruction*; *generic curriculum and instruction*, and *science-specific work with students*. Most teachers indicated they thought the program helped them improve in each of these three areas. In contrast, the non-TIP programs did not have mean ratings greater than "adequate" for any of the categories. In statistical comparisons between the subgroups, there was a significant difference between the means of TIP and non-TIP programs for the three categories as well (see Table 4a). TIP teachers reported that, on average, they learned more about *science-specific curriculum and instruction*, *generic curriculum and instruction*, and *science-specific work with students*.

Table 4

Means comparison of TIP and non-TIP program goal subscales

	Mean		Standard Deviation		Sample size
Goals Subscale	Non TIP programs	TIP program	Non TIP programs	TIP programs	# of matched pairs
Generic curriculum and instruction	2.83	3.63*	.8407	.8081	10
Science curriculum and instruction	2.36	3.88**	.9501	.7152	12
Generic work with students	2.45	3.18	.8926	.8382	11
Science-specific work with students	2.15	3.35**	.9364	.7867	12

*p<.05. **p<.01.

Note: Participants rated subscale items on a scale from 1 to 5. Subscale scores were computed by averaging the ratings on the subscale items. The items included in each subscale can be found in Appendix A. Since some respondents are in more than one program, significant difference between groups was determined using a two sample paired test for means only for those respondents in both TIP and at least one non-TIP program. Difference in sample sizes between subscales is due to missing data.

Table 4A

Program means of subscales

	Mean	
Goals Subscale	Non TIP programs	TIP program
Generic curriculum and instruction	2.30	3.57**
Science curriculum and instruction	2.88	3.71***
Generic work with students	2.88	3.23
Science-specific work with students	2.30	3.34*

* p < .05. **p < .01. ***p < .001

Note: Starred items indicate the subscale mean is significantly greater than or equal to a mean of 3.00 (adequate rating on CSTIQ)

The findings for TIP again reflected the program design and focus specifically on new science teachers. Yet, TIP participants perceived gains in items included on the *generic curriculum and instruction subscale* as well. This may be explained by the variety of workshops TIP offers that include "generic" topics like assessment, classroom management, and managing paperwork in addition to science curriculum topics like Newton's laws. We also often hear mentors and coaches giving TIP teachers tips on things like how to keep students on task or using techniques like a "warm-up" - a task students complete at the beginning of class while the teacher is taking attendance.

The findings related to the non-TIP programs are not accounted for so easily. It is, of course, not possible given the scope of the survey to explain the

low ratings of the other programs. Certainly a number of the items fall within the range of goals these programs address in their published descriptions. Both the PAR program and BTSA programs, for example, include formative assessment tasks where teachers work on particular aspects of their teaching they want to improve, like consistency with student discipline, or creating meaningful homework assignments. Perhaps it is a matter of "trying to be all things to all people." District induction providers must think of the needs of all their new teachers, not just the science teachers. Other matters or subjects, like literacy or mathematics, may seem more pressing for programs to address. In their efforts to do so much (with what is often a very limited set of resources) these programs may fall short of helping improve what, in teacher's eyes, is most important for their work. If, as the findings suggest, subject matter is most important to these teachers, then focusing on things like literacy might seem like a distraction from their "real" work.

Another way this science-orientation might show up in lower ratings is if TIP respondents who also participated in non-TIP programs tended to rate those programs more harshly than teachers who were not in the TIP program. Perhaps a district-mandated program attached to their workplace that may or may not have science-specific support pales in comparison with an "out-of-school" program that is not required and involves interaction with all kinds of interesting natural phenomenon. However, there was no significant difference ($p > .05$) between the mean ratings TIP and non-TIP respondents gave the non-TIP

programs. On average, both subgroups found the non-TIP programs did not help them develop the skills and knowledge included in the goals categories.

Of course, it is also possible the low ratings are the result of selection factors - perhaps only "disgruntled" participants of non-TIP programs and/or "satisfied" TIP participants responded to the survey. Regardless, as with program features, it is again the case that this group of teachers perceived their science knowledge and science teaching skills improved when they participated in an induction program that had science as its central focus. The next section of the paper takes a closer look at what these findings might mean for how credible the induction programs were for the new science teachers program providers intended to support.

Assessing program credibility - How well do induction programs support new science teachers in their work?

Reviewing the findings for the overall group of teachers, programs and respondents seem well matched in one category– *collegiality*. A majority of teachers chose *collegiality* as an important part of new teacher professional development and also reported they had opportunities to learn from, and with, others in their induction programs. Although a majority of teachers did not choose *seminar-type structures for learning* as important, these structures were also prevalent in their induction programs. Since, based on program descriptions, it is also quite likely that these seminars, workshops, etc. provided

some of the collegial interactions teachers valued, this finding might be considered an additional "match" on collegiality.

It might also be asserted that teachers and programs are well matched on the feature they found least important – compensation. The category most teachers selected as least important in a program for new teachers – compensation – was also the category they were least likely to get ($Z = -3.61$, $p < .001$). Although release time, reduced teaching loads, and fewer number of preparations are often advocated in the induction literature, most of these new science teachers did not find a majority of these features in their programs. Nor did they consider them a priority. Factors that may influence this situation will be further explored in the final section of the paper.

Although the findings suggest most teachers don't have opportunities for compensation in their induction programs, it is important to point out that the way the category was scored (at least three of the compensation items must be provided through the program) obscures the individual compensation items programs might provide. For example, if only two items were required, most TIP teachers would have indicated they did receive opportunities for compensation from their program ($Z= 2.98$, $p < .01$). The two features most respondents indicated TIP provided were "provides materials or money to buy materials" ($p < .01$) and "provides stipends for participation" ($p < .0001$). These findings are consistent with program descriptions and our case study work with teachers. TIP provides teachers with stipends for attending workshops, mentoring groups, and

the summer institute. Teachers are also given a stipend to purchase materials, often receive free materials at program sessions, and become acquainted with a variety of local resources where they can find the inexpensive science materials needed for Exploratorium classroom activities.

Although most teachers wanted opportunities for *science-specific support* in their induction program, only the TIP respondents could be certain of support that specifically addressed science and science teaching. This was also true for science-specific program goals. Most teachers wanted opportunities to learn more about science curriculum and instruction. However, only the TIP participants reported they improved their abilities in science curriculum and instruction as a result of their induction program. This was not the case, in general, for participants of the other programs included on the survey (however, as previously discussed, this should not be taken to mean that these teachers don't have opportunities for science-specific support outside of their induction program). It appears that the issue of science-specific support is important to most of these teachers. However, from their perspective, opportunities for assistance with science and science teaching are not readily available in all induction programs.

To summarize then, new science teachers reported they do have the opportunities to interact with others that most of them hope for in a new teacher support program. However, they are not likely to perceive that their induction program supports *science* teaching or contributes to the development of their

knowledge and skills for teaching *science* unless they are participants in an induction program that focuses specifically on science teachers and teaching.

This data suggests, then, that induction programs focused specifically on science teaching may be more "credible" with new science teachers than programs that do not have a disciplinary focus. Although this may seem like a foregone conclusion – of course new science teachers would be drawn to and perceive that they learn more about science teaching from an induction program that emphasizes science - it may not be quite that simple. New science teachers have to learn many things as they begin teaching which may or may not be seen as part of *science* teaching. Classroom management, for example, may be connected to science or seen as a "separate" discussion – something a teacher does to get students ready to learn science. What keeps new teachers focused on *science* teaching? Several possibilities – some that the survey data and research experience with new teachers can speak to – come to mind. In the following section, I draw on a few more analyses of the survey as well as experience working with new teachers to offer some conjectures about why this might be the case and to raise some concerns about the ways teachers and their induction programs mediate what the work of "science teaching" entails.

Implications - new science teachers and their work

There are many possible ways to explain the salience science-specific new teacher support have for these teachers. It may be that new science

teachers bring a "science orientation" with them to their induction programs. They may be the kind of people who can just never get enough science – the self-proclaimed science "geeks". Another possibility is confidence level in subject matter or science teaching. This could work in either direction. Teachers who are confident might want to protect their resources. On the other hand, those who are less confident might see improving their knowledge and skills as a priority. Perhaps other school responsibilities push them towards learning more about science and science teaching – curriculum committee work or being appointed science department chair.[5] While all of these are viable reasons why new teachers would set science and science teaching as a priority in their induction program, the survey data does not support the assumption that teachers set priorities for induction based solely on their own background or circumstances.

To test the assumption that teacher characteristics primarily determine their priorities for induction, relationships between what teachers selected as important and relevant background items included in the survey were analyzed. For all variables selected, the results showed that teachers preferred the categories that emphasized science irrespective of the number of science courses they had taken, their confidence in their subject matter knowledge or science teaching skills, their credential status, or their years of experience ($p > .05$). For example, teachers who rated themselves as "confident" or "very

[5] 5 of the 11 first year teachers who responded to the survey reported they were the science department chair

confident" in their current ability to understand and teach their assigned subject matter were no more likely to select *subject-specific support* as a feature of an induction program than teachers who rated their abilities as "moderately confident" or less on the survey. Likewise, teachers with clear licenses were no more likely to select science curriculum and instruction as a priority for induction programs than teachers who had preliminary licenses or intern standing.

Another possible explanation might be related to the impact of the programs themselves. Perhaps teachers who had regular opportunities to work on subject matter and science teaching in their induction program were inclined to want science-specific support as part of their induction experience. While it might be tempting to assume the power is only in the program itself, the survey findings do not support the assumption that programs are primarily responsible for the priorities teachers set for induction.

For example, teachers who were not in programs that targeted science teaching were just as likely as TIP teachers to select the science subscales as "most important" in a program for new teachers ($Z = -1.80$, $p > .05$). Furthermore, an analysis of questionnaire items related to mentoring indicated that teachers who frequently engaged in science-related activities[6] with their mentor were no more likely to select the science –specific categories than teachers who had

[6] Mean teacher rating of frequency (scale of 1-5) in mentoring activities on three items "finding and using science materials", "providing ideas for science lessons and activities", and "discussing science content."

few opportunities for science-specific support from their mentor ($t = -0.006$, $p > .05$).

To put it succinctly, then, neither the characteristics of teachers nor the structures and content of programs can sufficiently account for teachers' subject matter preference in their new teacher programs. However, the findings related to TIP do provide a more satisfying way to think about induction program credibility. The proportion of TIP teachers who selected *science-specific support* and *science curriculum and instruction* coupled with the high ratings TIP teachers gave the program on these subscales suggests a mutual shaping or strengthening effect. Teachers valued what they experienced in the program while, at the same time the program was responsive to what new science teachers felt supported them in their work.

Perhaps, then, the place to think about what might explain most new science teachers' priorities for their induction is some place *between* teachers and programs. A likely candidate is the workplace – the place where teachers and programs meet. And, the central task of that workplace for science teachers, especially those in middle and high school, is teaching *science*. That is the one commonality we can be certain of among these teachers. If these teachers' preferences for their induction programs are read as a signal of what they think the work is that they are being inducted into, then subject matter is a central piece of that work.

It might be helpful at this point to use the other preference most teachers had - *collegiality* – to illustrate this notion of the workplace, teachers, and programs acting together to co-mediate teacher's preferences for their induction programs. Teaching is often talked about as work that isolates adults from each other with few opportunities for contact with peers. Breaking through the isolation is at the heart of the formal induction movement. In the past, teachers were left to sink or swim, finding assistance where, and if, they could. It might be easy to assume that the teacher preferences for collegiality observed in this survey are evidence that formal induction "works." Teachers "learned" from their program that collegiality is important. Or, it could be taken as a reflection of the teachers themselves who are "collaborative" kind of people.[7] But, if cast in terms of the workplace, then these teachers' preferences for collegiality could just as easily be understood as resonance with the work itself – work that is best learned at the elbows of experienced others.

I do not intend to suggest here that the "others" should only be science experts, experienced science teachers, or other subject matter specialists. However, I do think it is a topic for careful study. While new science teachers may have opportunities for subject matter work in other professional development venues apart from induction, systematically exploring the

[7] The survey data can offer only one supporting piece of evidence here. In one section of CSTIQ, several items addressed interactions with school colleagues. Teachers with "high" school collegiality ratings were no more likely to select features from the collegiality subscale as a "most important" in new teacher programs than teachers with low school collegiality ratings.

messages sent by emphasis on subject matter within induction seems worthwhile. When the word "induction" is attached to a program - what does leaving science-specific support as an aside or to chance say about the work teachers are being inducted into? In subject matter terms, this may be a case of a replicating a "sink or swim" culture, in this case for science teaching.

If we do take these teachers' preferences for their induction programs as a signal of what they perceive the work is that they are being inducted into, then the place students have in the survey results also needs some attention. In this survey, both teacher preferences and what they reported happened in their induction programs gave science curriculum and instruction greater priority than science and students. We often see a similar pattern in the new science teachers who are our case study participants. Having something for the lesson – notes, activities, worksheets, a "warm-up," can easily and understandably seem like the bulk of the work. Given the focus of the national science standards movement on "science for all," continuing evidence of science achievements gaps between economic and racial groups, and the status of science as a "gatekeeper" school subject for full citizenship in an increasingly technological society, science and students must be at the center of the work of science teaching. What would it mean to bring students central to the work of science teaching? How would that be reflected in the priorities of new science teachers and programs?

Finally, a few comments about compensation – the one category most teachers ranked as least important. In many ways, this finding lends further support to the notion that teachers' preferences for induction are an indicator of how they perceive the work they are being inducted into. Teaching is not known for its financial rewards or professional status. Sociological studies of teaching (Lortie, 1975) point out that intrinsic rewards are more important to teachers in their work than extrinsic benefits like salary. But why is that the case…because extrinsic rewards seem out of reach? As previously mentioned, new teachers are constantly overwhelmed with the demands of their work. It would seem that reduced course load, fewer preparations, or release time to work with other teachers would be a relief. Although, as described below, our case study work adds some insight, much about the compensation issue remains a puzzle.

First, our case study teachers often tell us how much they appreciate the stipends programs provide for work outside of school time that, as they put it, makes them feel like they are being treated as a "professional." Teachers also regularly tell us how much they value the materials and science activities made available to them through TIP or other programs. Teachers find these resources supportive on two levels – they are immediately useful in their classrooms and they also acknowledge the scarce resources for science teaching many teachers find are available to them in their school. However, we also occasionally find that something in the compensation category considered

"support" may not feel that helpful to teachers. One such example is related to release time. Although release time might seem a good way to offer teachers opportunities to pursue professional development during the school day, several of our teachers do not feel they can take advantage of release time. They talk about the time demands of preparing for a substitute. They complain that, despite careful planning, they often come back to find that the lesson plan wasn't followed or as one teacher put it, "no learning took place." They also have to face a "pile of detentions" on their desks. These teachers feel their primary responsibility is to be in their classroom, not out "doing professional development." Yet, they also hate to pass up opportunities to improve their teaching. What is intended as "support" begins to feel more like an additional pressure.

Similarly, despite well-intentioned efforts to ease new teachers loads, new teachers may feel their professional status threatened by reduced course loads or fewer preparations. In their experience of the teaching workplace, "student " teachers have reduced course loads and fewer preparations while "full time" teachers carry heavier loads. Special accommodation for beginners might feel like a step back. We find most new teachers we encounter are happy to leave their student teaching days behind and join the ranks of full-time teachers. A "full load" may be a symbol of their unofficial membership in those ranks.

The concerns I have just raised underscore the point that understanding how science teachers experience induction programs in the reality of their teaching lives is no easy task. The complexities are enormous. However, as formal induction programs continue to multiply, induction mandates (funded or not) are passed, and countless induction materials are published, it is important to continue to listen closely to teachers – not necessarily from a "customer satisfaction" perspective but to understand more about what teachers perceive they are being inducted into and the implications for the work of teaching and for their students. In this survey, new science teachers remind us that the credibility of an induction program rests in its ability to support teachers in the work of science teaching. Understanding what these teachers value in professional support for new teachers helps us better understand how they perceive their work and the support needed for that work. This seems a compelling leverage point for designing or refining new teacher professional development as well as induction research. It would certainly be a waste if the bandwagon of induction passed science teachers by.

References

Feiman-Nemser, S., S. Schwille, C. Carver, &B. Yusko. (1999). *A conceptual review of literature on new teacher induction.* Washington,DC: National Partnership for Excellence and Accountability in Teaching.

Lortie, D. C. (1975). *Schoolteacher: A sociological study*. Chicago: The University of Chicago Press.

Appendices

Table A1

Program features subscales

Subscale	CSTIQ item
Collegiality	Item 2a. Formally assigns a mentor or coach
	Item 2b. Provides release time to observe other teachers
	Item 2h. Provides common planning time with teachers in your subject or grade level
	Item 2m. Provides peer coaching in teaching
	From teachers in my school
	From teachers in other schools
	Extra classroom assistance from administrators/staff
	Item 2n. Provides regular supportive communication with principal, other administrator, department chair, or staff
	Item 2o. Promotes collaboration and joint work among teachers:
	With other new teachers
	With experienced teachers
Compensation	Item 2c. Provides materials or money to buy materials
	Item 2d. Provides a stipend for participation
	Item 2e. Provides a reduced teaching schedule
	Item 2f. Takes place primarily within my school/district
	Item 2g. Provides a reduced number of preparations
Generic support	Item 2k. Focuses on general teaching techniques
	Item 2p. Provides regular opportunities to provide feedback on how well the program meets my needs
	Item 2q. Provides regular opportunities for feedback from program leaders on the progress of my teaching
	Item 2r. Recognizes and builds on individual teachers knowledge and experience

Table A1 (cont.)

Program features subscales

Subscale	CSTIQ item
Science-specific support	Item 2j. Focuses on subject matter content
	Item 2l. Focuses on teaching techniques specific to subject matter
	Item 2s. Provides assistance from science content experts or specialists
	Item 2t. Provides science teaching resources (lesson plans, activities, etc.)
Seminar-type structures for learning	Item 2i. Offers seminars or classes for beginning teachers
	Item 2u. Provides intensive opportunities for learning how to teach (e.g. summer institute, ongoing workshops or study groups, etc.)

Table A2

Program goals subscales

Subscale	CSTIQ item
Science-specific curriculum and instruction	Item 4a. Know the concepts, knowledge, and skills of the subject matter you teach (e.g. science, math).
	Item 4b. Use the state's curriculum frameworks and performance standards to plan instruction.
	Item 4c. Evaluate science curriculum materials
	Item 4d. Use teaching strategies that promote student inquiry.
	Item 4h. Know how to find/create resources for use in science teaching.
	Item 4i. Evaluate and use technology to enhance science teaching/learning.
	Item 4j. Maintain an orderly, purposeful science learning environment.
Generic curriculum and instruction	Item 4e. Choose different teaching strategies for different instructional purposes.
	Item 4f. Plan instruction by using knowledge of learning, subject matter, curriculum, and student development.
	Item 4g. Use a variety of assessment methods.
Science-specific work with students	Item 4l. Understand how different students learn science
	Item 4n. Develop science lessons and units that motivate students to learn.
	Item 4p. Teach science in ways that support new English language learners.
	Item 4r. Tailor science teaching and curriculum to individual students' needs.

Table A2 (cont)

Subscale	CSTIQ item
Generic work with students	Item 4k. Set appropriately challenging learning expectations for students.
	Item 4m. Help students become self-motivated and self-directed.
	Item 4o. Understand students' social, emotional, physical, and cognitive development.
	Item4q. Encourage students to see, question, and interpret ideas from diverse perspectives.
	Item 4s. Teach in a high poverty, urban school.
	Item 4t. Work with parents and families to better understand students and support their learning