Science Fairs, Inquiry, and Project-Based Learning:

Perspectives from Intel Educator Academy Participants

Peter Rillero, Ph.D
Ron Zambo, Ph.D

College of Teacher Education & Leadership
Arizona State University

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Introduction

Intel has a goal to promote participation in science fairs and enhance inquiry and project-based learning in schools. Intel's strategies to achieve this goal include support in foreign countries and USA states with an Intel presence for local education managers, technology labs, and regional science fairs that affiliate with the Intel International Science and Engineer Fair (ISEF). In addition, each year in conjunction with Intel ISEF, Intel holds the Educator Academy, which is attended by people who have been actively involved with Intel, though multiple contact points, to promote inquiry, project-based learning and science fairs.

This project sought data to help determine which functions of the multiple outreach activities have the most impact on science fair competitions in the view of people who have a history of involvement with Intel using past and present (2006) participants of the Educator Academies as the data source.

New inductees were surveyed before and after the 2006 Educator Academy to determine the effects of the program on their perceptions of their effectiveness in forwarding Intel's goals. A sampling of inductees were also interviewed before, during, and after the Educator Academy.

Graduates of the Educator Academy (2002 to 2005) provide perspectives on how Intel's local efforts have helped them to be successful in promoting inquiry, project-based learning, and science fair participation. Analyses of success stories and the characteristics of academy participants and their local environments may provide insights for future academy recruitment and ways that Intel can enhance success at the local level.

Goals

Jon Price, the K-12 Education Research Manager, consulted with Intel leadership personnel from around the world and then presented to us the needs and interests of the group. We captured these needs and interests in the following five general evaluation questions that frame this program evaluation.

1) What are the benefits of the Educator Academy and how can it be improved?

2) From the perspective of the Educator Academy Graduates, what role does Intel play in supporting science fairs, inquiry, and project-based learning in their locales?

3) How can Intel's support of science fair participation, inquiry, and project-based learning at the regional level be improved?

4) What are the characteristics of highly successful Educator Academy Graduates?

5) What is it about the local environment that makes some Educator Academy Graduates highly successful?

Abbreviations and Operational Definitions

Educator Academy (Educator Academy): This is the Intel sponsored academy that is held in conjunction with Intel ISEF.

Educator Academy Graduate (EAG): This is a person who has successfully completed the Educator Academy.

Educator Academy Inductee (EAI): This is a person who is entering the Education Academy in May of 2006. Prior to and during the Educator Academy they will be referred to as Inductees. After they successfully complete the academy they will be referred to as Educator Academy Graduates.

Science Fairs: Activities that bring students together to present their inquiry projects and to have them judged.

Inquiry: Learning about aspects of the world by asking questions, designing procedures, interpreting data, and communicating the results.

Project-Based Learning: A learning approach where students engage in projects that span a minimum of several days.

Data Sources

This evaluation used interviews, observations, and an online survey as data sources. With the exception of interviews with Educator Academy (EA) coordinators and observations of the Educator Academy, the data collection will focus on the Educator Academy Inductees (EAIs) and Educator Academy Graduates (EAGs). The connection between the goals and the data sources are presented in Table 1.

Table 1. Evaluation Goals and Data Sources

Evaluation Goals	Initial EAG Interviews	Initial EA Coordinator Interview	Section A Online Survey: About the Educator	Section B Online Survey: Perceived Abilities	Section C Online Survey: Intel Support	Section D Online Survey: Levels of Success	Section E Online Survey: Local Environments	Section F Perspectives on the EA	Observations of EA	Interviews with EAIS
	Data Sources									
1 The EA	x	x		x				x	x	x
2 Perceived Role of Intel	x				x					x
3 Improving Intel Support	x				x	x	x			x
4 Successful EAGs	x	x	x	x		x			x	
5 Local Environment Success	x					x	x			x

Initial Interviews

Phone interviews with Educator Academy graduates and the Educator Academy coordinator sharpened our understanding of the goals and the events in the Educator Academy and were used to construct the online survey. Sample questions for the Educator Academy graduates were: What was the primary benefit of the Educator Academy? What occurs in the Educator Academy? What did you do differently as a result of the Educator Academy? How could the Educator Academy be improved? In what ways do Intel efforts help you, teachers, or students in your local areas? What are things about your school or community that helped you to succeed? What are things about your school or community that were barriers to success?

Sample questions for the Educator Academy coordinator were: In your own words, what are the goals of the Educator Academy? What occurs in the Educator Academy? What would you like to learn about the Educator Academy graduates and their work? What changes have occurred in the Educator Academy? What data might lead you to change a part of the Educator Academy?

Online Survey

The online survey, administered to Educator Academy Inductees and Educator Academy graduates, collected data in six key areas. These areas are: (a) demographic information about the person, (b) perceived abilities in target areas, (c) perspectives on Intel efforts to support inquiry, project-based learning, and science fairs, (d) levels of

success indicators, (e) the local environment, and (f) perspectives on the Educator Academy and its influence on future activities.

The complete survey link was e-mailed to three cohorts of Educator Academy graduates. These are as follows: graduates of 2005 or one year after completion of the Educator Academy (Y1), graduates of 2004 or two years after (Y2), and graduates of 2003 or three year after (Y3).

The six major sections of the online survey are presented below in outline form. As previously indicated, the development of items will be informed by interviews with Educator Academy graduates and with Educator Academy coordinators.

A special pretest survey was prepared for the Educator Academy Inductees. This survey was administered to the Educator Academy Inductees at the start of the Educator Academy in Indianapolis. This administration was the pretest (PRE). They also completed the full online survey at the conclusion of the Educator Academy as a posttest. For consistency with labeling the other cohorts, the posttest administration will be named Y0.

a. About the Educator (Y1-Y3)
b. Perceived Abilities (PRE, Y0-Y3)
c. Perspectives on Intel efforts to support inquiry, project-based learning, and science fairs (Y1-Y3)
d. Levels of success indicators (Y1-Y3)
e. The local environment (Y1-Y3)
f. Perspectives on the Educator Academy (Y0-Y3)

Observations of the Educator Academy

The evaluation team observed the Educator Academy in Indianapolis for the entire one-week period, participating in some events, and conducted a Shop Talk session (Data for Decision Making) and developed a deeper understanding of the program. This assisted our interpreting of data and developing recommendations.

Interviews with Educator Academy Inductees

We conducted interviews with the Educator Academy Inductees while they were in Indianapolis. A purposeful selection of six Educator Academy Inductees ensured geographic, gender, and educational situation diversity. The Educator Academy Inductees were interviewed (a) after their arrival in Indianapolis but prior to the start of the program, (b) during the program, and (c) immediately after the program.

Online Survey: Results and Recommendations

This section presents data from the online survey, the interviews, and the observations of the Educator Academy. The online survey was answered by 136 participants for a return rate of 46.4%.

Who are the Educator Academy participants?

The three most common age ranges of Educator Academy participants are 31-40 (27.9%), 41-50 (30.9%), and 51-60 (28.7%), which makes this a well-distributed group by age. Considering the entire population the respondents are also well distributed by

gender with 48.5% male and 51.5% female. The respondents are also well distributed by year of attendance, with a slight majority (n=37) attending in 2004, followed by 2006 with 36, 2005 with 32, and 2003 with 28 respondents. The respondents are also equally distributed between US (53%) and non-US countries (47%) composed of participants from 25 different countries.

Categorizing by broad geographical region the number of participants from each area is as follows: Asia 28, Europe 26, Latin America 10, and US and Canada 72. Considering gender and geographic region together, as shown in Table 1, the Latin America and the US and Canada region had more female than male participants, while Asia and Europe had more males than females. Since in all regions the ratios are about 2:1, a recommendation is that recruitment of participants for future Educator Academies aim for more equal gender ratios within regions.

Table 1. Gender and Geographic Region

	Asia	Europe	Latin America	US and Canada
Females	8	8	7	47
Males	20	18	3	25
TOTAL	28	26	10	72

Table 2. Population Density and Geographic Region

	Asia	Europe	Latin America	US and Canada
Rural	3			9
Suburban	3	3		34
Urban	22	21	9	29
TOTAL	28	24	9	72

NOTE: Less than 136 because of missing data.

The majority of respondents (59.6%) come from urban areas with 29.4% from suburban areas, and 8.8% from rural areas. The urban majority is found in Asia, Europe, and Latin America as shown in Table 2. Of the respondents to the item on family income levels, the families of their students were about the same (37.9%) or lower (37.9% responded to the categories of lower or much lower) than the families in their general areas. About one-quarter of the respondents on this item indicated that their families had higher incomes.

Just under half of the respondents had masters degrees as their highest degree, and approximately one-quarter held doctoral degrees. The positions held by the participants were as follows: 14 government administrators, 11 school administrators, 73 teachers, and 12 in the other category which includes employment in museums, as consultants, and in universities. About 55% of the respondents were teachers. The average number of years teaching reported was 14.5 years and they teach an average of 146 students per year. Most of the teacher respondents taught multiple subjects (62.7%). The most common subject taught was biology (45.3%) followed by chemistry (38.7%) and physics (38.7%). The average length of time working with science fairs is reported as 6.8 years.

Know How: What do they report knowing how to do?

The respondents to this survey express confidence in many areas. Overwhelming, as shown in Table 3, they report understanding inquiry practices (97.8% agree or strongly agree) and being able to support teachers with science fairs (97.8%). They indicate they understand project-based learning (94.8%), they know how to effectively recruit students for science fairs (93.4%), and that they have the ability to support teachers in inquiry and project-based learning (93.4%).

Table 3. Knowledge and Abilities of Teachers

No.	Item	A or SA	Mean	SD
2.1	Understand effective science or math inquiry practice	97.8%	3.56	0.54
2.6	Abilities to support teachers involved with science fair	97.8%	3.49	0.54
2.2	Understand project-based learning	94.8%	3.45	0.59
2.3	Knowledge to effectively recruit students for science fairs	93.4%	3.34	0.61
2.5	Support teachers in inquiry and project-based learning	93.4%	3.42	0.62
2.4	Effectively organize a science fair	85.3%	3.27	0.71
2.7	Effectively promote a science fair	83.1%	3.17	0.72

Two areas that they indicate they are not as strong in are the ability to effectively organize a science fair (85.3% agree or strongly agreeing with 13.2% disagreeing or strongly disagreeing) and the ability to effectively promote a science fair (83.1% agree or strongly agreeing with 15.5% disagreeing or strongly disagreeing).

Analysis of Variance (ANOVA) was employed to determine significant differences based on the following factors: Locale (urban, suburban, urban), Gender (female, male), Year of participation in the Educator Academy (2003, 2004, 2005), Position (Teacher, School Administrator, Government Administrator, Other), and Geographic Location (Asia, Europe, Latin America, US and Canada). Significance was set at the $p < 0.01$.

There were no significant differences by LOCALE, GENDER, or GEOGRAPHY on items 2.1-2.7. There were significant differences based on POSITION. The Others, composed of a mixture of consultants, museum related personnel and university people, rated themselves lower than all of the other groups on 2.1, Understanding effective science or math inquiry practice.

There were also significant differences by YEAR on items 2.1, 2.3, and 2.4. The figure below shows the pattern of agreement on the three items.

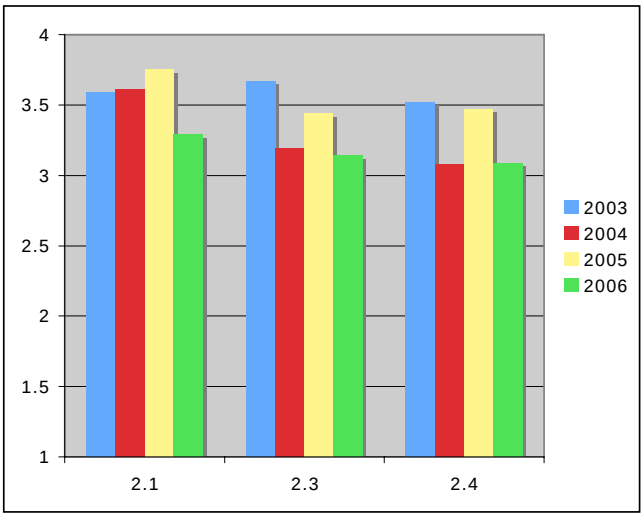

Figure 1: Means for items 2.1, 2.3, and 2.4 based on year in the program.

The Local Environment and Educational Change

While Educator Academy participants have knowledge and abilities, is their local environment conducive to effecting change? Specifically is it a good place for promoting inquiry, project based learning, and science fairs? Table 4 presents the data from the items with a stem "The local environment is a good place…."

Table 4. The Local Environment is a Good Place…

No.	Item	A or SA	Mean	SD
2.17	to help students develop inquiry skills.	90.4%	3.21	0.61
2.15	to increase science fair participation.	87.5%	3.16	0.64
2.14	to promote project-based learning.	86.8%	3.09	0.64
2.16	to make changes in educational programs.	78.7%	3.01	0.75

More than three-quarters of the Educator Academy participants felt that their local environment is a good place to make changes. To be sure, the means of these items were lower than the mean for their knowledge and abilities. This is not surprising as it is generally easier to give one person knowledge or skills than to effect change in a system. And educational systems have historically been difficult to change.

It is interesting to note that the item on helping students develop inquiry skills is higher than increasing science fair participation. This may be because inquiry skills can be developed within the context of the classroom, whereas science fair participation often requires work outside of school. Project based learning is also lower, than the previous two, although the differences are small, it does suggest the possibility that perhaps some teachers view project-based learning as an out-of-class experience rather than an in-class experience. This should be explored in future evaluations.

Item 2.16 "The local environment is a good place to make changes in educational programs in the schools" was the lowest for this group. If items 2.14, 2.15, and 2.17 are viewed as making changes in educational programs, then item 2.16 should be similar in

its mean. The lower mean for item 21.6 suggests that perhaps items 2.14, 2.15, and 2.17 can be accomplished without formal changes in educational program, and they are therefore more easily done.

Two other items not presented in Table X are also indicators of the local environment. Item 2.12 “Students in my locality go to school ready to learn” was agreed or strongly agreed to by 61.9% of the respondents. For item 2.13 “Teachers in my locality have what it takes to help children learn about scientific inquiry” the percent in agreement was 61.1%. Despite the majority agreement, the relatively low percentage as compared to other items suggests that these items should be explored more. What are barriers to students coming to school early? For respondents who don’t feel teachers have what it takes to help children learn about inquiry, what is it about the teachers that make them have this opinion? Is there a deficiency, for example, of knowledge, that can be addressed through inservice education workshops?

Analysis of Variance did not find significant differences for items 2.14 to 2.17 for LOCALE, YEAR, GENDER, or GEOGRAPHY. There was a significant difference by POSITION on Item 2.17. The “Others” agreed less strongly that their local environment was a good place to help student acquire inquiry skills.

Why do Students Participate in Science Fairs?

In past evaluations of Intel ISEF, this evaluation team uncovered various motivational influences on students pursuing science fairs. This evaluation, from the prisms of Educator Academy participants, pushed to find the primary motivator. The results are unfortunately not clear.

Table 5. Reasons for Student Participation in Science Fairs

Stem: The primary reason that students in my locality participate in science fairs is

No.	Item	Strongly Agree	Agree	Mean	SD
2.22	their teachers.	33.1%	51.5%	3.16	0.71
2.18	their interest in science.	16.2%	45.6%	2.76	0.76
2.23	the improvement of their college applications.	7.4%	35.3%	2.37	0.81
2.21	the opportunity for local recognition.	4.4%	34.6%	2.34	0.71
2.20	their parents’ encouragement.	3.7%	22.8%	2.19	0.67
2.19	the opportunity to attend Intel ISEF.	5.1%	19.9%	2.08	0.80

The items, which are listed by ascending mean, indicate that most participants viewed teachers as the primary reason why students participate in science fairs. But it should be pointed out that only 33.1% of the respondents strongly agreed with this item. It is reasonable that teachers are an important influence but it seems as though they would exert their influence by tapping into other motivational factors. Perhaps they would appeal to the students to do science fairs because they know how much the student loves science or to improve their college application or for the recognition, or to attend Intel ISEF. Yet these motivators all scored low.

The interpretation of this data is challenging. With the teacher as the biggest motivator perhaps no other motivators are needed. So by way of the teachers' authority ("You will do this!") or charisma the students are motivated to participate in science fairs. Combining the strongly agree and agree responses 84.6% of the respondents selected teachers, 61.8% interest in science, 42.6% college application improvement, and 39% local recognition. It is interesting to note the relatively low percent agreement for parents (26.5% A or SA) and for the opportunity to attend Intel ISEF (25%).

We explored the hypotheses that perhaps the world region where the respondent was from would influence how motivational the opportunity to attend Intel ISEF is. For example, the opportunity to come to the USA for a trip seems like it might be extremely motivational for students in either very distant or less financially well off countries. Interestingly, there were no significant differences for respondents based upon world difference. There was also no difference based upon world regions for the importance of parental involvement.

There were, however, significant differences on items 2.18 (interest in science) and 2.21 (the opportunity for local recognition). These means are presented in Table 6.

Table 6. Means by Geographic Regions on Two Items with Differences

	Asia	Europe	Latin America	US & Canada
2.18 Interest in Science	2.96	3.23	2.90	2.49
2.21 Opportunity for local recognition	2.64	2.27	2.80	2.21

The large mean for Europe for interest in science as a primary motivator is interesting. In all cases, perceived interest in science was perceived to be a greater motivator on interest in science than local recognition. It is worth pointing out that item 2.21 scored better than item 2.19, the opportunity to attend Intel ISEF with a mean of 2.08.

There was also a significant difference by LOCALE on item 2.21. People from Rural communities ranked the importance of local recognition higher than suburban and urban with means of 3.73, 3.24, and 3.03, respectively. There were no significant differences by GENDER or YEAR on items 2.18-2.23. There was also a significant difference on item 2.22 (teachers as the primary motivators) for POSITION with School Administrators giving teachers the greatest importance (mean = 3.56) and teachers giving themselves the least importance (mean = 2.54).

While teachers may see past themselves and look at characteristics of students in finding primary motivators, the largest mean for primary influence was still the teachers. The implications for this data presented in this entire section are profound. If teachers are the primary reason, and the goal is to increase science fair participation, then motivating more teachers may be the optimal way to achieve this. With Intel ISEF as the lowest motivator then pouring more prize money into this event would produce the least return.

Support for Science Fairs

Support for science fairs comes from a number of sources. Items in section two and three were designed to evaluate the importance of various items concerning support.

These are arranged in descending order by the percentage of respondents who strongly agreed or agreed. The results are contained in Table 7

Table 7. Sources for support for Science Fairs

No	Item	Strongly Agree	Agree	SA or A	Mean	SD
2.9	The leaders in my organization support science fairs.	39.0%	45.6%	84.6%	3.25	0.71
3.1	Intel's support of science fairs at my region has been effective.	42.6%	40.4%	83.0%	3.23	0.85
2.8	The leaders in my organization support inquiry and project-based learning.	33.8%	48.5%	82.4%	3.16	0.73
2.27	Without our school system support our science fairs would be much weaker.	28.7%	52.9%	81.6%	3.10	0.71
2.25	Without Intel support our science fairs would be much weaker.	43.4%	33.8%	77.2%	3.19	0.87
2.26	Without other businesses or community organization's support our science fairs would be much weaker.	22.1%	50.7%	72.8%	2.91	0.82
3.4	Teachers' support of science fairs at my region has been effective.	11.0%	57.4%	68.4%	2.78	0.65
3.6	The overall level of support is consistent from year-to-year.	5.1%	63.2%	68.3%	2.72	0.59
3.3	My school system's support of science fairs at my region has been effective.	19.1%	47.8%	66.9%	2.79	0.83
3.2	Other businesses or community organization's support of science fairs at my region has been effective.	14.0%	51.5%	65.5%	2.73	0.80
3.5	Parents' support of science fairs at my region has been effective.	5.9%	47.1%	53.0%	2.53	0.70
3.7	The overall support increases from year to year.	6.6%	45.6%	52.2%	2.58	0.68

The data suggest that leadership in the respondents' organizations is an important part of science fairs. A strong majority also suggests that Intel's support at the regional level has been effective as shown by item 3.1. In fact, of all the items in Table 7, the two with the strongest percentage of strongly agreeing are items 3.1 and 2.25 "Without Intel support our science fairs would be much weaker." The support of Intel from the Educator Academy participants is even more important than school system support. An important reminder is important here, these are regions where the influence of Intel is strategically

applied, and it is unlikely that this influence would be seen as strong in other places around the world. Nevertheless, the impact of Intel on these regional science fairs is seen as effective and important. Besides Intel support the relative support of the following agencies are listed in order of perceived effectiveness: (a) teachers, (b) school system, (c) other business or community organizations, and (d) parents. About one-half of the respondents agreed or strongly agreed that the level of support increases from year to year.

From the ANOVA, there were no significant differences by LOCALE or YEAR on the above items related to support. There was a significant difference by POSITION on Item 2.25. Levels of agreement that without Intel support science fairs would be weaker significantly varied between School Administrator, Government administrators, teachers, and others with means of 3.50, 3.25, 3.13, and 2.80, respectively.

There was a significant difference by GENDER on Item 3.1 with Females expressing stronger agreement than males that Intel's support of science fairs has been effective in their regions with means of 3.44 and 3.00. There was a significant difference by GEOGRAPHY on Item 3.1 with means for the regions of US and Canada-3.45, Latin America-3.25, Asia-3.04, and Europe-2.71. The differences on Item 3.1 for Geography were most likely caused by the large proportion of females from US and Canada.

Beyond organizational support, technology resources, mentors, and access to outside laboratories are important for science fairs as shown in Table 8.

Table 8: Technology, Mentors, and Labs

No.	Item	SA or A	Mean	SD
2.29	Technology resources are very important for successful science fairs programs.	95.6%	3.40	0.56
2.28	I would like greater assistance in helping match students with out-of-school mentors.	89.7%	3.32	0.69
2.10	Students in my locality have access to mentors in their pursuit of science.	60.3%	2.67	0.8
2.11	Students in my locality have access to outside laboratories.	40.4%	2.33	0.8
2.24	We receive outside support in finding out-of-school mentors for our students.	37.5%	2.32	0.83

The respondents overwhelmingly indicated that technology resources are very important for successful science fair programs. There was also a strong need expressed for help in matching students with out-of-school mentors with 89.7% agreeing or strongly agreeing to this item. Approximately 60% indicated that their students have access to mentors, while only 40% indicated access to outside laboratories. An even smaller percentage (37.5%) agreed or strongly agreed that they had support in finding out-of-school mentors. There were no significant differences for these five items by GENDER, LOCALE, YEAR, POSITION, or GEOGRAPHY.

Additional Training

On Section Two of the survey is the open-ended question: In what areas would you benefit from additional training? The responses were categorized into groups and 21 categories that held responses from more than one person were created. This section reports on the top five categories and then categories that were created that may be most pertinent.

1. Mentoring. The most mentioned area for additional training is in the area of student mentoring. Twenty-three different people mentioned the need for training in mentoring. The responses were short, mostly one to three words, so no illustrative quotes are presented. In our past program evaluations of Intel ISEF it was also clear that mentoring is a big concern about teachers, in part because many of the projects were mentored by people with great expertise outside of the school environment. Another category named "Outside Research Lab Opportunities" had seven comments.

2. Teacher Support. Although this category has diverse aspects the 16 comments make this an important area to consider for more training. Interestingly, the concern is not that Educator Academy Participants receive more training on teacher education rather it is a subtle call for getting other teachers as allies in the process. The following three quotes are illustrative of this: (a) "more teacher support & people around us support," (b) "Encouragement & support from school districts and from more teachers," and (c) "teacher's consciousness."

These comments are interesting because of interview observations from previous evaluations. A very few schools, most notably one in New Mexico, seemed to have comprehensive science fair systems with lots of teachers involved. Many others seemed to have a "lone wolf" that did most or everything on their own. In one focus group the teacher lamented that when she retired science fair would stop. The Educator Academy experience is designed to be a group experience as a group of participants work on an action plan. The realization of the difficulties in working alone and the realization from the Educator Academy about how it could be a team effort may motivate teachers to seek other ways to involve colleagues at their schools. Teachers are asking for more support in this area.

3. Judges. Thirteen people mentioned something about judges. The quality of judges at the local and regional fair is an issue. Presumably because many participants take leadership roles in running fairs, they would like more training on judges. Unfortunately, because the responses are short, the exact nature of the training on the judges is not clear.

4. Volunteers. Eleven participants requested more training in the area of volunteer recruitment and use.

5. School Support. Nine participants comments were categorized in this area. These comments tended to focus on principal and administrative support rather than just on the support of their colleagues.

6. Promotional/Media Support. Eight participant comments focused on the need to raise interest in science fairs through media and making posters.

Additional Support

On Section Three of the Survey is the question, "What types of non-financial support are most important for your science fair?" The responses to this open-ended

question were categorized and the most common and interesting results are not presented. The complete results are presented in Appendix D.

There were 19 comments about mentors, such as (a) access to labs and mentors, (b) help with mentors, and (c) mentors for student projects. There were 11 comments about judges; such as (a) we need better judges at the regional level. I suggest that judges at the local and regional levels should also be trained/updated and (b) judges according to their specialization.

There were seven comments about school system support including (a) School System's Support and (b) support from parents and school principals. Six comments related to access to outside research laboratories including (a) Allowing the students access to third level lab facilities and (b) opportunity to have outside lab facilities. There were also six comments about the need for media support including (a) media support and (b) media presence and interest.

Another open-ended question was 3.7 what do you need to effect change in your zone of influence? These responses are presented in Appendix E. The top categories for this question are now presented. There were two categories with 13 responses. These were (a) money and (b) teacher support and buy in. With 12 responses was the category of time and with 11 responses was district support.

The Enabling Educator Academy

At this point in the report the data presented were the perceptions of Educator Academy participants that may or may not have been influenced by their participation in the academy. The report now shifts to focus on likely outcomes of the academy.

Table 9 presents data from Section 4 of the survey. The items are listed in descending order by percentages of respondents agreeing or strongly agreeing with the items.

Table 9. The Educator Academy…

No.	Item	Strongly Agree	SA or A	Mean	SD
4.4	...prepared me to improve science fairs.	56.6%	94.9%	3.52	0.61
4.2	...prepared me to promote inquiry learning.	37.5%	91.9%	3.3	0.62
4.3	...prepared me to promote project-based learning.	39.0%	91.2%	3.31	0.63
4.7	...prepared me to grow my local science fair.	42.6%	90.4%	3.33	0.66
4.1	...was what I expected it would be.	36.0%	89.7%	3.26	0.65
4.5	...prepared me to train teachers.	32.4%	83.8%	3.16	0.71
4.6	...prepared me to be a leader.	32.4%	82.4%	3.14	0.72

The rankings suggest the Educator Academy helped participants develop knowledge and ability to improve science fairs (94.9% indicated agree or strongly agree), promote inquiry learning (91.9%), promote project based learning (91.2%), and grow their local science fair (90.4%). While still a strong majority, the program had lower scores for helping participants to train teachers (83.8%) and to be leaders (82.4%).

The rankings of the items correspond with our observations of the Educator Academy foci. The emphasis was on science fairs, which includes inquiry learning and project-based learning. The training of teachers was a component of action plans but it was not emphasized in the Shop Talk presentations.

Although items 4.2 to 4.4 all have greater than ninety percent agreement, it does make us wonder why these percentages were not closer to 100%. Perhaps multiple uses of the terms inquiry and project-based learning may have resulted in lower scores on these items. But for item 4.4 on improving science fairs, there is no ambiguity in terms and the Educator Academy had a clear and consistent focus on science fairs. We posit two hypotheses to possibly explain this: (a) that some participants had already achieved great expertise in science fairs prior to coming to the Educator Academy and (b) some international participants may have had English language difficulties and this limited their benefiting from the academy. While during our observations of the Educator Academy we did meet individuals that could be put into categories (a) and (b), we have no quantitative data to evaluate these hypotheses. It should also be pointed out that in the case of item 4.4 it is only 5% of the participants who did not agree or strongly agree.

For item 4.1 (The Educator Academy was what I expected it would be), 89.7% of the participants agreed or strongly agreed. This seems reflective that the participants were prepared for their experiences.

Does being a teacher versus being a non-teacher influence perceived benefits of attending the academy? This question is pertinent as if there was a difference it might influence future academy recruitment. Therefore, an analysis of variance (ANOVA) was conducted for profession and the likert-items in Section Four. It revealed no significant differences between teachers and non-teachers providing evidence that both groups benefited equally. Perhaps the teachers and non-teachers varied in their Section Four responses by geographic group. The analyses revealed no significant differences providing evidence of equal benefit.

For Teachers Only

More perspectives about the Educator Academy were explored in Section 6 of the online survey, which was only for teachers. One half (68) of the 136 respondents were teachers. The group of teachers was different from the total group in that 62% were female with only 38% being male and a full 75% of the teachers were from the US (51) with 5 from Asia, 9 from Europe, and 3 from Latin America. In the full sample the split between female-male and US-foreign are almost equal. Items about the effects of the Educator Academy on teachers are presented in Table 10 by descending order of the sum of the strongly agree and agree responses.

Table 10. Effects of the Educator Academy on Teachers

No.	Item	Strongly Agree	Agree	SA or A	Mean	SD
6.6	My participation in the Educator Academy has helped me use project-based teaching.	40.4%	51.7%	92.1%	3.31	0.65
6.12	As a result of Educator Academy, I am more likely to encourage students	48.9%	42.0%	90.9%	3.38	0.72

	to ask questions to guide investigations.					
6.11	As a result of Educator Academy, I am more likely to place a greater emphasis on inquiry skills.	41.4%	49.4%	90.8%	3.31	0.67
6.7	As a result of Educator Academy, I am more likely use hands-on science or math.	44.3%	44.3%	88.6%	3.31	0.73
6.8	As a result of Educator Academy, I am more likely to assign projects that span several weeks.	37.9%	47.1%	85.1%	3.21	0.75
6.14	As a result of Educator Academy, I have helped the general public see the importance of science fairs.	33.7%	43.0%	76.7%	3.07	0.82
6.10	As a result of Educator Academy, I am more likely to use technology in my instruction.	28.4%	47.7%	76.1%	3.02	0.77
6.13	As a result of Educator Academy, I have helped the general public see the importance of science.	33.0%	39.8%	72.7%	3.01	0.86
6.9	As a result of Educator Academy, I am more likely to give lectures.	17.2%	13.8%	31.0%	2.33	0.94

The highest agreement was for the item 6.2 that the Educator Academy helped participants use project-based teaching. The second highest item was for item 6.12, about encouraging students to ask questions to guide investigations, which is a central inquiry strategy. Only 31% agreed wit item 6.9, which is a positive result as lectures are often viewed as the antithesis of inquiry-based and project-based instruction.

Item 4.9, an open-ended item in this section was: “The most useful thing I learned at the Educator Academy was.” These responses were highly variable and readers of this report are urged to read through Appendix F. The response category with the most comments was sharing (10), followed by improving science fairs (9), and knowledge around the world (8). For example, some comments on sharing were (a) sharing ideas and good practices, (b) we all face the same challenges and obstacles as educators, and (c) sharing best practices and networking opportunities.

Comments about improving science fairs include (a) fair development, (b) how to organize the science fair, and (c) science fair models. For the knowledge around the world category, which had much overlap with sharing, comments included (a) “what other people from around the world were doing with science,” (b) international approaches and common goals/issues, and (c) educational systems and emphasis differ from country to country.

A pertinent remark from the 2006 interviews at the Educator Academy is presented to help illustrate the “knowledge around the world” category.

> Interviewer: Just overall with the Educator Academy so far, what’s most valuable?

> Participant: The most valuable part I guess for myself is the exposure to what the other countries are doing, to be able to benchmark what we do in [country name deleted] our country in connection with what other countries are doing, how far along are we, what are the trends across countries, are we going along with the trend, are we far behind. And I've been able to do that by listening to the Shop Talks and interacting with different delegates from the other countries I think that's very helpful to be able to see what they are doing, to be inspired by the enthusiasm and the drive and the passion for science that these people are demonstrating.

Eight comments specifically mentioned Project-Based Learning. And to illustrate the importance of program evaluation and sharing data, three participants mentioned our "Data for Decision Making" presentation using Intel ISEF evaluation data as a springboard for discussion as the most useful thing.

One notable item received only one comment. Each year, the underlying constant has been that the Educator Academy has been held in conjunction with Intel ISEF. Yet, only one comment focused on Intel ISEF itself. This deserves more scrutiny. If learning about and experiencing Intel ISEF is not a powerful outcome, perhaps greater utilization of resources would be achieved by having Educator Academies in different regions of the world that are closer to the participants. Localized Educator Academies would reduce travel costs and US visa problems, and be held at lower cost facilities such as university dormitories. This would not necessarily be to replace the Educator Academy at Intel ISEF but held in conjunction with it. However, another interpretation of the lack of comments is that the participants didn't view the Intel ISEF experiences as part of the Educator Academy but they might have still viewed them as important.

A good summary of this section is perhaps presented in two of the comments: (a) too many to say! and (b) too many to list, well done.

Measurements of Impact

This section looks at the data from Educator Academy participants who had at least one year to implement what they learned at the academy. Specifically, these data come from 2003, 2004, and 2005 participants in their responses to items in Section Five.

Out of the 97 participants from 2003 through 2005, 47 (48%) had data from before and after the Educator Academy about the number of participants in their science fairs. Nevertheless, the data provides evidence about the effectiveness of the Educator Academy, as shown in Table 11.

Table 11. Numbers of Students in Science Fair Before and After Educator Academy Participation

No.	Item	Low Range	High Range	Mean	Grand Total
5.1.1	# students competing before EA	0	1900	282.9	13,296
5.1.2	# students competing after EA	0	6000	635.9	29,889

As indicated by the mean and the grand totals, the number of students more than doubled (125.1% increase) from before the Educator Academy to after the Educator Academy.

The participants were asked if they did teacher training as a result of the academy. Out of the 97 teachers, 54 (56%) indicated yes and provided a number of teachers trained. The number of teachers trained as a result of the academy was reported as 43,597 or an average of 807 teachers for every participant reporting data. This is an impressive number but an examination of the data reveals that one participant reported 33,000 teachers trained. Since he was from China, this does not seem to be unreasonable. But removing that China number results in 10,597 teachers trained, or an average of 196 teachers per respondent.

The average number of workshops conducted was 6.5 and the average number of contact hours per workshop was 6.6. Open-ended item 5.2.4 was, "What were the topics of the workshops/events?" Project-Based Learning was the most written with 12 responses, followed by organizing science fairs with 9 responses, and inquiry learning followed by 8 responses. These workshops seem consistent with the focus of the Educator Academy.

The Project Plan

Questions 5.3 and 5.4 were "After implementing your plan, how would you rate it in retrospect?" and "How much of your Educator Academy Project Plan did you implement?" For the respondents who answered question 5.3, 14.6% rated their projects excellent/well developed, 66.3% good/solid, 20.2% moderate/fair, and 3.4% weak/flawed. For the respondents who answered question 5.4, 12.0% indicated all, 49.0% most, 33.7% some, and 5.4% none. For item 4.8, Working on the Project Plan during the Educator Academy was time well spent, 86.7% of the respondents agreed or strongly agreed.

There were 76 responses to open-ended item 5.6, what, if any, was the biggest barrier to full implementation to your Educator Academy Project Plan? These are presented in Appendix I. It is no surprise that the largest barrier is time with 19 responses. Second was teacher support with 15 responses, followed by money and district support each with 10 items.

There were 77 responses (Appendix J) to item 5.7: Reflecting on your plan and its implementation, what is the one topic of most significance that the Educator Academy should continue to address in the Educator Academy curriculum? The three clusters of responses were identified as follows: (a) examples, (b) funds, and (c) community/government support. Some illustrative "example" comments are (1) giving examples of successful fairs, (2) examples of other schools, and (3) examples of successful partnerships.

The 56 responses to item 5.8 reflecting on your plan and its implementation (What is the one topic of most significance that the Educator Academy should add or change in the Educator Academy curriculum?) were the most diverse ranging from award for teaching to dynamic geography and the clusters held few responses each. The most mentioned category was how to recruit with four people suggesting this. Second was support and third was promotion.

Pre-Post Test Results

The 2006 participants were given a six-item survey to complete at the onset of the Educator Academy. They were asked to provide a four-digit number that we could use to

match their pre-test responses to their responses post Educator Academy. Of the 55 completed pre survey, 19 were matched to the post-test results. The results are presented in Table 12. Scores increased on all 6 of the items with statistically significant increases on three of the six.

Table 12. Pretest Posttest Comparisons

No.	Item	Pre	Post	Gain
2.4	Effectively organize a science fair	2.36	3.05	0.69*
2.5	Support teachers in inquiry and project-based learning	2.63	3.32	0.69*
2.2	Understand project-based learning	2.89	3.56	0.67*
2.7	Effectively promote a science fair	2.47	2.89	0.42
2.3	Knowledge to effectively recruit students for science fairs	2.74	3.05	0.31
2.1	Understand effective science or math inquiry practice	3.31	3.47	0.16

*Indicates that the differences between the pretest and posttest were statistically significant.

The largest and statistical differences in items 2.2, 2.4, and 2.5 were for items on project-based learning, organizing science fairs, and supporting teachers in inquiry and project-based learning. These were dominant themes of the Educator Academy and growth in these areas is a desired outcome. It may be instructive to consider items where there was the lowest amount of gain and no significant differences. Item 2.1 on understanding effective science or math inquiry practices ended up with the second highest posttest mean. Since the pretest mean was the highest at the start, however, the increase was not significant. A plausible conclusion from this is that the participants felt strong at the onset about their knowledge of inquiry practices.

This possible conclusion is supported by most of the interview data for the 2006 participants at the beginning of the Educator Academy. Two of these are produced below:

> Interviewer: Imagine students engaged in the highest level of inquiry, describe what those students are doing?
>
> Participant1: Those students are actively wondering and pondering questions about how something works or what types of processes are going on, and entire knowledge to those thoughts and eventually the get the whole picture.
>
> Participant2 (in separate interview): Umm I think that those students would be making observations, asking questions about what they observed, umm discussing conjectures about making hypothesis, then searching for literature to see whether there is already answers for them, and there are not or if there is a gap in the knowledge they will construct their own methodology to be able to answer the questions that they have then format a plan an try to come up with answers.

The lack of significant differences between pre and posttest scores for items 2.3 and 2.7 suggest recruiting students for science fairs and promoting sciences fairs as possible areas for more Educator Academy emphases. These items also were in the bottom three for posttest means. In that group is also item 2.4 on organizing science fairs. Although the significant differences between pre and posttest scores suggest that participants learned about organizing science fairs, the low posttest score suggests this could be an area to consider for greater focus.

Phone Interview Results

Prior to the Educator Academy, six graduates from prior years were interviewed via telephone regarding: Professional development and their growth as teachers; science fairs in which they have been involved; needs of teachers in their community for professional development; support for science fairs in their communities, and their ideas of "inquiry" and "project-based learning."

The six were chosen based on the year they participated in the Educator Academy (two from 2003, two from 2004, and two from 2005), whether they were from the United States or another country, and whether they were teachers at the time the participated in the Educator Academy. We were not able to reach some of the graduates who were randomly selected from each of the categories, so other participants who most closely matched the original criteria and who we were able to contact became the participants in the interviews. The sample included one person from the Philippines, one from Chile, and four from the United States.

Professional Development

The teachers interviewed reported that they participated in professional development opportunities. They reported taking workshops and institutes related to science content, how to teach science content, and general instructional strategies. The specific experiences ranged from the DNA Boot camp focusing on biotech activities to district wide meetings regarding newly adopted textbooks.

They reported that the programs they attended enabled them to integrate more inquiry and hands-on strategies into their teaching, enabled them to make science more relevant to their students with up to date topics (for example forensics), which had the adding benefit of kept the teachers excited about science.

The professional development that was most useful provided them with ideas that had been proven at other schools (or elsewhere) that they could take back to their classrooms and use immediately, and that were innovative and likely to capture the interests of students. They also appreciated that ability to contact the presenters after the workshops if question arose and they appreciated that the workshops were well organized.

When asked what other professional development regarding teaching would be of value to them, they stated: questioning, reading, and writing in science; new topics like forensics and biotech to get kids more excited about science; and their state-standards.

In regard to things about their school or community that help them to grow as a teachers, they commented on the support of parents and the community, the students that

were willing to learn and competitive in their levels of knowledge, other teachers who were interested in research, and Intel and other agencies who supported their professional development.

However, they did see obstacles to their professional growth. These in general had to due with a lack of resources. In one state it was lack of funding due to limitations of property taxes. Another felt that their school and district concerned primarily with dealing with the fast growth in their region and that quality was an issue to deal with at some future time. One teacher mentioned that there was no support to start a science research class at her school.

Science Fairs

The participants' roles in science fair were widely varied. One reported having no involvement with science fairs. Another reported that his school did not have a science fair but that he encouraged good interested students to go to the regional fair and to support them he had started a science club that provided the time for students to prepare their projects and for him to give his guidance. Another has been working with their school science fair for 20 years and has recently been designated as the chair of the regional fair and president of the state science fair. The person with a long history of science fair involvement recalled that she first became interested in science fairs as a place for her science students to showcase their work, much like a talent show or a sporting event.

Multiple sources of support for science fairs were reported. Intel provided boards and supplies for science projects, sponsored a camp for middle school teachers, and employees from Intel worked with students. Other entities also provided support, for example, Synopsis Corp. funded a science club, the Kiwanis Club and a local educational foundation financed prizes and supplies for students, schools provided stipends for science fair directors, local newspapers featured print articles about science fairs, and a church donated the use of their meeting hall to hold a science fair.

When asked where they gained the knowledge to run science fairs, the list of responses included: the Intel Educator Academy, state level meetings about science fairs, a course at a state university, observations of other science fairs, work with teachers who have science fair experience, reading articles in journals such as *The Science Teacher*, and just trying it and solving problems as they arise.

When asked specifically about attending professional development related to science fairs, the participants listed the Intel Educator Academy and one said that they had a state level meeting about science fairs.

The results of the professional development were that teachers obtained a better idea of all the things they could do to promote science fairs and that they were better able to deal with the paperwork. They considered the meetings useful because it enabled them to network with others and hear new ideas, the meeting helped to clarify deadlines and rules, and it helped them to learn some of the procedures of conducting a science fair. They felt that professional development that targeted how to convince teachers to participate would be of use. One commented that his colleagues seemed talented and interested in science fairs but that they did not have the time. Also, it would be of use to have professional development opportunities about how to implement science fair programs that allowed time to work on plans for implementation.

Teacher Training

The participants thought that teachers in their area needed more professional development in inquiry-based learning and science research. However, only one had been involved with providing any. One person was a presenter at a summer institute on inquiry, learning, and technology that was supported by Intel.

Support of Science, Science Teaching and Science Fairs

When asked about attempting to increase public support for science and science fairs, the responses were limited. They included asking the principal, getting parents involved, and holding a district wide science fair informational meeting for teachers. When asked what evidence they have of success, the only response was that they got new science tables for the lab.

Educator Academy

Participants were also asked specific questions about the Educator Academy. They thought that the primary benefit of Educator Academy was that: it provided them a step-by-step way of doing science fairs, it sparked in them a renewed interest in possibilities of hands-on science, it enabled them to meet people from different places and other countries and hear about what others are doing, it exposed them to successful programs from other schools, and it provided them time to make plans of their own. They thought that to be successful an Educator Academy graduates take the new ideas they learned regarding successful science fairs and share them with others, and increase participation in science fairs. The attributes that Educator Academy graduates need to accomplish those goals are: enthusiasm/passion for science, the willingness to learn, creativity, the willingness to do the hard work, the willingness to take the time, diplomacy, and fortitude.

Inquiry and Project Based Learning

Intel's goals include the promotion of inquiry, project based learning, and science fairs. We asked the participants to define the terms inquiry and project based learning. The term "inquiry" along with the term "hands on" was used frequently during these interviews. The term project-based learning was never used in answering the questions.

In regard to inquiry, the basic description involved coming up with a question, gathering information, and then answering the question. Variations on the basic description included terms like, discovery, scientific method, students who want to learn more about a topic, and having students try things on their own.

In regard to project based learning two types of responses were given. The first involved hands on experiments that allowed students to find out about science on their own. The second involve students producing a product using previously acquired skills as practice of those skills. It thus appears that while inquiry has general agreement about its meaning, project-based learning does not.

Observations and Interviews at the Educator Academy

The Educator Academy

Our observations and participation in the Educator Academy lead to the conclusion that it is a thought out and well-planned enterprise. The logistics that we observed flowed smoothly and without problem, from the meals to the scheduling of sessions. The Master of Ceremonies for most of the meetings had an engaging style that was both friendly and serious at the proper times. The guest presentation was an inspiring and provocative speech about educating students about the man-made world. The moral of the participants seemed extremely high from the start to the finish of the week.

As former teachers and now university faculty, we must confess that we are not used to this scale of largess. The meeting facilities were wonderful, the special meals were fabulous, and the ordinary meals and snacks were great. The excellent treatment certainly contributed to the high morale of the participants. Yet, if budgets become leaner this might be an area for cost reductions.

The sequence of events was logical. A get acquainted, icebreaking session, flowed into carefully planned shop talk presentations sprinkled with protected work time for the groups, culminating in the presentations of the action plans followed by the award ceremony of Intel ISEF.

In our own inservice education programs, we find sheltered work time to be a very helpful strategy for teachers to develop plans and teaching materials. While we certainly were not privy to observing the work of most groups during these times, it did seem to us that some groups were using the times for alternate activities such as sightseeing and shopping. While this can be a productive use of time, we suggest that future evaluations try to ascertain if the amount of sheltered work time was just enough or too much. It seems plausible that many groups or team leaders already had a strong idea about their action plan at the beginning of the week and thus, not as much work time was needed.

Many of the Shop Talk presenters seemed like they had well thought out programs and great enthusiasm. It seemed like a good balance between US and non-US presenters, with presenters from the Philippines, Costa Rica, and Ireland. The role of the presenters might be thought about more. First are our impressions and then our recommendations. The presenters are brought in for a couple of presentations but they stay for the entire week. They may attend other Shop Talk presentations.

We attended a couple of Shop Talks where members of the audience who were American Shop Talk presenters dominated the discussion phase. There are a couple reasons why this would happen: (a) the Shop Talk presenters are very knowledgeable and enthusiastic about the topic and therefore they are eager to join the discussions, (b) because they are American with English as their native language and a culture where it is generally okay to talk a lot and they understand the culture, (c) and because they are very comfortable with the environment as this may be their second or third Educator Academy. The negative of the interactions is that it inhibits the contributions of others without these characteristics. So our recommendation is that a cautionary note be given to Shop Talk presenters that they not dominate discussions of the sessions where they are audience members.

Then what is the role of the presenters when they are not presenting? We suggest giving them a greater role. For example, every work team should be assigned a presenter who is their resource person. This person does not necessarily participate in the work sessions but stops in every now and then to ask if they have questions, concerns, or needs. Before doing their final presentation, the teams could be required to present their plans to their resource person for initial feedback and practice. It might also be a good idea to have different resource people "host" some of the snacks. During some times, especially during the free work time, the snack area was quite empty. The host could be at a table where they have a specific topic that they could engage with participants who were interested.

Educator Academy Interviews

In other areas of this report, the results of interviews were used to help illustrate data or support conclusions. Pertinent data that were not presented earlier are presented now.

The interviewees did not have major concerns at the start of the Educator Academy. The only concern voiced was sitting too long but in the middle interview, that individual said it was not a problem as most afternoons she could take walks.

Selection for the Educator Academy

The interviews suggested that there is no standard way to select participants for the Educator Academy, and that the process appears to be very random. There is no clear sense of how or why these people were invited. But most did have connections to students doing research.

> Interviewer: How were you selected for the educator academy?
>
> Participant 1: Uh, it's a complicated story, so the Intel person in "country name" (deleted) asked the nomination to my government and the government recommended me, and yeah that's the process.
>
> Participant 2 (Separate Interview): Our Principal sent out an e-mail asking if we were interested, and I replied back that I'd be very interested because I've been to the international science fair before, because of my brother so I knew that did a lot of different things that I thought would be really valuable to come out and participate in while our district was chosen.

It is our recommendation that the organizers of the Educator Academy, in consultation with regional education managers, develop give clear guidelines on the type of person that should attend the Educator Academy. Recognizing that the Educator Academy could benefit a broad spectrum of people, the organizers may also decide to have different flavors in different years with different presentations tailored to the needs and interests of the groups. Examples of different flavors include: (a) school administrators, (b) high school teachers, (c) middle school teachers, (d) government officials, and (e) non-profit, non-government organizations.

It was indeed the perception that the 2006 group had a "flavor" and that it was a good thing, as presented in the following dialog from the last interview group.

> Interviewer: so did the Educator Academy meet your expectations?
> Participant: Yeah I had a great time meeting people from other countries and I learned a lot from listening to the country plans seeing the variety of perspectives on how to teach science education in each country. I heard from the old timers that come here every year that this is the best one so far, and they cited a reason and the reason is the representatives are policy makers so I think there are more concrete plans and higher levels of participation for the administration officials. Being a high school teacher I was fortunate to be a delegate even though I am not a policymaker. So this is a different experience for me I have attended teacher training and seminars but this time with policymakers I got to have a peak into the minds of those who are on the top level positions of every country.

Of course different Shop Talks appeal to different people as is presented in this quote.

> Some of the shop talks I find them very helpful in relation to the work that I do but some they were out of context for example the COSMOS presentation, it was a state wide program, I got some ideas but most of it was not applicable to what I do, probably if I got promoted, in a different office where I do that work I could use that.

Along with the characteristics of individual participants of the Educator Academy, the composition of the teams was also not clear and appears to be somewhat random. One participant was by himself. Another was with another teacher and an Intel employee she had never met. While their may be symbiotic power in having teams composed of diverse members, more thought should be put into who should constitute a team and then the presentations can be targeted towards the strengths and needs of the team.

What would you do differently?

When participants were asked what they are going to do when they return, clear and detailed ideas were presented. We view this as a significant positive outcome of the Educator Academy.

> Interviewer: What will you do differently when you go back home as a result of the Educator Academy?
> Participant: I have become more conscious or aware about introducing inquiry as a skill so I think that is one of the things I will mention to my director, to start off research class with analysis and inquiry and to build on it for the rest of the year so that's something. Another, to give more recognition to students to allow them to show their work, and I'll try this, that is one thing I'm wondering I'll try to look for partnerships with

companies and businesses. And also listening to action plans. Also because we already introduce students to email scientist and researchers all over the world I'll try to initiate a project to set up a database of these researchers who have emailing with the students for the past year for this year. So collecting the email addresses and building a database of scientist that are helpful to secondary students to high school students.

More Suggestions

This section is ended with miscellaneous suggestions that came up during the interviews.

- English for non-native English speakers. Speak slow, use microphone properly
- Who are the audience? Give detailed information to Shop Talk presenters about who their audience will be.
- Give site-specific logistics in advance. For example, one participant did not expect it would be as cold as it was.

Successful Participants and Environments

This section explores goals three and four of this project that attempt to determine what Educator Academy graduates are successful and what types of environments they are from. This section describes the process that was used to develop a profile of individuals who have been successful as Educator Academy Graduates along with the results of that process.

Science Fair Participation

Past graduates of the Educator Academy from 2003, 2003, and 2005 were asked "If you have the data, how many students participated at your science fairs before and after your involvement with the Educator Academy." Out of 97 eligible, 47 provided numbers of students. It is not clear why 50 participants did not respond to these questions and that fact needs to be kept in mind as the results are presented.

The first step in the analysis compared those who supplied numbers to the 50 who did not. Chi-square analyses revealed no significant differences related to POSITION, LOCALE, AGE, GENDER, GEOGRAPHY, or YEAR of attendance. However, the data showed that more School Administrators and Teachers reported numbers. This seems reasonable because they seem more likely to have access to science fair participation numbers.

Next, a percent increase (or decrease) was computed based on the before and after figures. Those percent ranged from a high of 299,900% (2 before and 6000 after) to a low of -67.67%(15 before and 5 after). Percent increase of 50% and higher were considered as HIGH increases and those below 50% were considered as LOW.

Chi-Square analyses determined that there was a significant difference for POSITION. Teachers, the most frequent position, were twice as likely to be in the High Increase group than the Low increase group.

There were no significant differences for the other grouping categories of LOCALE, AGE, GENDER, GEOGRAPHY, or YEAR of attendance. However,

differences between GEOGRAPHIC locations approached significance with participants from the US regions being twice as likely of being in the High increase group than the Low increase group. Differences between YEAR of attendance also approached significance with the percent of participants in the High group highest from 2003 and decreasing to 2004 and 2005. It seems as though working in the US has a positive influence on increasing science fair participation as does the number of years it has been since attending the Educator Academy.

Next, participants were labeled as high if the increase the number of science fair participants was higher than 100 and low if they reported increase less than 100. Chi-square analyses found no significant differences. However, a difference in LOCALE approached significance with relatively more High increases from Suburban locales and relatively more Low increases from Rural and Urban locales.

Teacher Training

Teachers were also asked if they conducted teacher training as a result of EA. Of the 93 responding, 56 responded YES and 37 responded NO. Chi-square found no significant differences between the two groups on POSITION, LOCALE, AGE, GENDER, GEOGRAPHY, or YEAR. Responses for LOCALE approached significance with a higher percentage from urban settings responding yes and higher percentages from Rural and suburban setting responding no.

Next, the participants were grouped by number of teachers trained. Those who reported training 50 or more teachers were labeled High and those below 50 low. Chi-squares analysis found no significant differences for POSITION, LOCALE, AGE, GENDER, or YEAR. However, there is a significant difference by GEOGRAPHY a higher relative percentage of participants from the US reporting Low numbers and higher percentages from Europe and Latin America reporting High numbers.

Completion of Project Plan

Participants were asked how much of their Project Plan was implemented with choices of All (11), Most (45), Some (31), and None (5). Chi-square found no differences between these groups for POSITION, LOCALE, AGE, GENDER, or GEOGRAPHY. However, there was a difference by YEAR. The percent of respondents reporting that they had completed all or most of their project plans in 2003, 2004, and 2005 were 50%, 54.3%, and 79.3%, respectively. There seems to have been a significant improvement for the 2005 graduates. It is not clear as to whether the completion of the projects was due to a change in the Educator Academy that year or some other factor.

The five who responded that they had completed NONE of their plan all attended in 2005, two were from ASIA and three from the US. When asked about obstacles only two responded with 1) Strengthening the collaboration with Education Ministries, and 2) different emphasis in our Malaysian educational system. It appears the three from the US had no obstacles to report.

Other Environmental Components of Successful Candidates

To determine any environmental factors that might contribute to the success of Educator Academy candidates Analysis of Variance was applied to 24 questionnaire items to related to the participants' localities and support for science fairs. Reporters

versus Non-reporters of science fair participation were compared. There were no significant differences. Second, those who reported High, Medium, or Low numbers for science fair participation were compared. Once again there were no significant differences.

Next, the responses of participants who reported training teachers were compared to those reporting not training teachers on the 24 items. ANOVA found a significant difference for item 2.18 with those who did training more strongly agreeing than those who did not that, "The primary reason that students in my locality participate in science fairs is their interest in science", with means of 2.96 and 2.39 respectively. ANOVA also detected a significant difference on that same item between teachers who trained a high number of teachers compared to those who trained a low number with means of 3.30 and 2.76, respectively.

Conclusions

This section presents the goals of the project and some of the conclusions that were presented in the report.

1) What are the benefits of the Educator Academy and how can it be improved?

The pre-post-test comparisons give a strong indication that the Educator Academy helps participants effectively organize a science fair, support teachers in inquiry and project-based learning, and understand project-based learning. Over 90% of the respondents agreed or strongly agreed that the Educator Academy had prepared me to (a) improve science fairs (94.9%), (b) promote inquiry learning (91.9%), (c) promote project-based learning (91.2%), and (d) grow my local science fair (90.4%).

The respondents reported that their science fairs had more than doubled in participation as a result of the Educator Academy. Approximately 43% of the respondents indicated they did teacher training as part of their action plans and 43,597 teachers were reported trained as a result of the academy.

Suggestions for consideration in improving the Educator Academy are as follows: (a) Develop explicit descriptions of who should attend the academy and the composition of the team. (b) Consider having different "flavors" for different academy years, such as middle grade teachers, high school teachers, school administrators, and government officials and have the sessions of those academies focus on the needs of the participants. (c) Increase the impact by having Satellite Educator Academies in regions closer to participants. These would not necessarily replace the Intel ISEF Educator Academy but increase its effect at a much lower cost, as transportation, lodging, and food could be obtained at far lower cost. Coordination could be made between the Satellite Educator Academy and the Intel ISEF Educator Academy with possibilities that the best satellite teams earn a trip to the Intel ISEF Educator Academy or participants from the Intel ISEF Educator Academy share what they learned and did with the satellites. (d) Consider the roles of the Shop Talk presenters during times when they are not presenting. Specifically their expertise might be used throughout the week in various ways and some presenters might need explicit instructions to not dominate discussions when they attend a session as an audience member.

2) From the perspective of the Educator Academy Graduates, what role does Intel play in supporting science fairs, inquiry, and project-based learning in their locales?

From the perspective of the Educator Academy participants, Intel's support of science fairs has been effective and important. For example, 83% of the respondents agreed or strongly agreed that Intel's support of science fairs in their region has been effective and 77.2% agreed or strongly agreed without Intel support their science fairs would be much weaker. For a relative idea of the impact, compare the first item wit item 3.3 where only 69% felt their school system's support of science fairs has been effective and compare the last item with item 2.27, where 81.6% agreed or strongly agreed that without school system support their science fairs would me much weaker. This establishes Intel as an important partner in science fairs.

3) How can Intel's support of science fair participation, inquiry, and project-based learning at the regional level be improved?

On the open-ended question concerning areas where teachers need more training and areas where teachers need more support, the number one response for each had to do with mentoring of students for their science fair projects.

Working with a scientist as she conducts her research is perhaps the easiest path to doing cutting edge research. Students who have this type of mentor have an advantage. Of course, other mentoring relationships exist, such as scientists being available to guide student interests.

Mentoring is a complex issue. Our previous evaluations of Intel ISEF expressed concerns that it caused students to do inappropriate projects for high school students, that it inhibited more students from getting involved in science fairs because they couldn't compete against the mentored projects, and that some areas, most notably rural areas, did not have these mentoring possibilities. We have suggested that Intel and Science Services consider separate categories for mentored and student-centered projects.

This type of change does not appear on the horizon, so it is our suggestion that Intel support science fairs by forming a group to promote equal access to mentoring. It would be the charge of this group to examine successful mentoring systems that some schools have established along with successful and unsuccessful mentoring relations between mentors and mentees. Then teacher workshops could inform teachers how to help their students acquire mentors. Perhaps incentive or recognition programs could also be created that help universities and industries supply more mentors for students.

Another area that teachers need assistance is in garnering more support from other teachers and for school system support. Science fair programs that have one teacher doing it all are likely to result in less creativity, less energy, more burnout, and no system for training successors. While it could be that appeals for help to colleagues with information about the power of science fairs could help recruit other teachers, it seems as though policies at the school or district level would do more. Intel should consider putting together a group to come up with suggested policies for schools and districts regarding science fair support and participation. Then educate teachers and administrators about the policy and leverage resource to enact it.

Finally respondents indicated a need for training and help with judges at the regional level. Workshops can be held for science fair organizers on training judges and perhaps workshop or videos can be developed that help judges to do more reliable and efficient judging of science fair projects.

4) What are the characteristics of highly successful Educator Academy Graduates?

This is a question that was not asked directly on the questionnaire, but that we have attempted to answer by comparing participants who seemed to be successful to those were less successful. The indicators of success we used were the recruitment of students for science fairs, the training of teachers, and the completing of the projects they planned. Some tendencies emerged. First, it appears that teachers are more likely than other occupational groups to report high percentage gains in science fair participation. Second, the Suburbs may be a better place to increase enrollment in science fairs than Urban or Rural environments. However, that may be because in many areas suburbs are where population growth is the strongest. Third, Urban settings might be the best places to train high numbers of teachers. This could be attribute to a possible high concentration of teachers in a small area. Last, teachers who attended the Educator Academy in 2005 were much more successful in implementing their projects plans. Possibly there have been changes in the guidelines for the creation of those plans or the Educator Academy has been revised to better prepare participants to plan and implement.

5) What is it about the local environment that makes some Educator Academy Graduates highly successful?

This is also a question that was not directly asked on the questionnaire and is addressed to some extent in the question of characteristics of the person. An answer was sought in comparing the responses of successful participants to less successful participants in the answers they gave to items targeting their local environments. The only significant result was that both participants that reported high increases in science fair enrollment and participants who reported high levels of teacher training thought more strongly that students in their locales participated in science fairs due to their interest in science compared to those at lower levels.

Taking the findings about successful candidates and their environments, one can only conclude that a person can be successful, or unsuccessful, regardless of their locale, country of origin, gender, and so forth. Possibly the belief that your students like science, coupled with personal attributes such as fortitude and passion and the like, can propel individuals to work with science fairs and teachers to promote what they believe is good for their students who love science.