

Science-Fair Scorecard of Dallas/Fort Worth Area Independent School Districts

by Ramesh S. Hegde, Ph.D.

Abstract

In an effort to glean insights into the Dallas Region Science and Engineering Fair (DRSEF) participation from Dallas/Fort Worth (DFW) area independent school districts (ISDs) as a measure of student interest and competitiveness in Secondary Science Education (grades 7 – 12), a research analysis of 12 years of DRSEF data (1999 - 2010) was undertaken, with specific focus on the most recent 4-year data (2007 - 2010). Plano ISD, with 11.7% of the total annual student enrollment share of the area ISDs, leads the pack with 46.9% share of the total projects participating at the DRSEF and a participation index (PI) of 402, indicating a more-than-four-times the average likelihood of participation at the competitive event. Coppell ISD with only 2.3% of the student enrollment share had a participation index of 322. Among the 13 major ISDs included in the analysis, Dallas ISD with the largest student enrollment (30% of total) ranked a distant 8th (PI = 60) and Garland ISD with the second-largest (12.6%) student enrollment ranked 7th (PI = 70) in DRSEF participation index. Interestingly, Plano ISD, with the highest number of projects entering DRSEF in both Physical and Life sciences categories, had higher number of project entries in the Physical sciences category than in Life sciences category. By contrast, Dallas, Garland and McKinney, three other ISDs with significant number of participating projects, had more projects in Life sciences category than in Physical sciences. The findings reported here have significant educational (science education, in particular) and community implications in the DFW metropolis.

Introduction

Another year of Elementary and Secondary Schools Science Fair competitions has gone by for the Independent School Districts (ISDs) in DFW metroplex. As is well known, participants compete in several science-subject categories at their schools, first. The winners then advance to the dis-

trict level and from there go to regional, state and international level competitions. With hundreds of thousands of dollars at stake in scholarships and awards, the competition at this event is intense and at the highest level can be termed as Science Olympiad for pre-teens and teens.

Speaking of teens competing in Science, let us look at some facts as they relate to Science literacy of U.S. students in the international context. In a recent international exam – Program for International Student Assessment (PISA), 2006 - that is supposed to assess the ability of 15-year-olds to apply Math and Science knowledge in real-life situation, students from the United states ranked 21st among the 30 countries of the Organization for Economic Cooperation and Development (OECD) that were part of this competitive assessment (1). Results from the study showed that U.S. students scored lower than the OECD average and that they lagged behind their peers in 6 of the 27 non-OECD countries in Science literacy (1, 2). Although there are differing opinions among experts on the validity of this study, results nevertheless support the notion that all is not well with the Science Education in the United States; perhaps there is either a declining interest in Science education among U.S. students or quality of Science education in the nation, something which is not easy to measure, has been deteriorating.

Another report (3) also provides supporting evidence that even though overall enrollment in Science and Technology (S&T) fields increased in the last 15 years, the relative share of S&T enrollment has declined. The policy report also pointed out that the

existing statistical data are not adequate for measuring and analyzing the levels of student interest. With this backdrop, the current study was undertaken with the following objectives:

- To analyze the recent trends in Dallas Regional Science and Engineering Fair (DRSEF) participation, as a measure of interest/competitiveness in science education, at the junior (grades 7 & 8) and senior (grades 9 – 12) divisions of DFW area ISDs of public-school system, charter schools and other private institutions
- To share the case-study analytical findings with the science coordinators and/or administrators of ISDs so that with the supporting evidence they have of their level of Science-fair participation vis-à-vis their peers they can make an informed decision on improving their science education
- To publicize the results of the case study so that legislators and policy makers at the State-level and administrators of ISDs devise ways for maintaining (wherever ISDs have an edge over others) and/or improving Science education in ISDs

Definitions of Metrics/Analytical Techniques

- Average or Mean – arithmetic average of the data included in the study or analysis
- Data normalization – is a technique that allows data in different scales to be brought to a common scale with the application of a mathematical or statistical operation so that the data can be compared and valid conclusions drawn.
- Participation per thousand (PPT) = (number of participating projects/students enrolled)*1000.

- Participation Index (PI) = (share of science-fair participation as % total/share of student enrollment as % of total)*100. Indexing is a data normalization technique that helps make “apples-to-apples” comparison of various ISDs on their level of participation. An index of 100 indicates average participation. Participation index of >100 (over-indexing) is above-average participation and <100 is below-average participation (under-indexing).

Data and Analytical Methodology

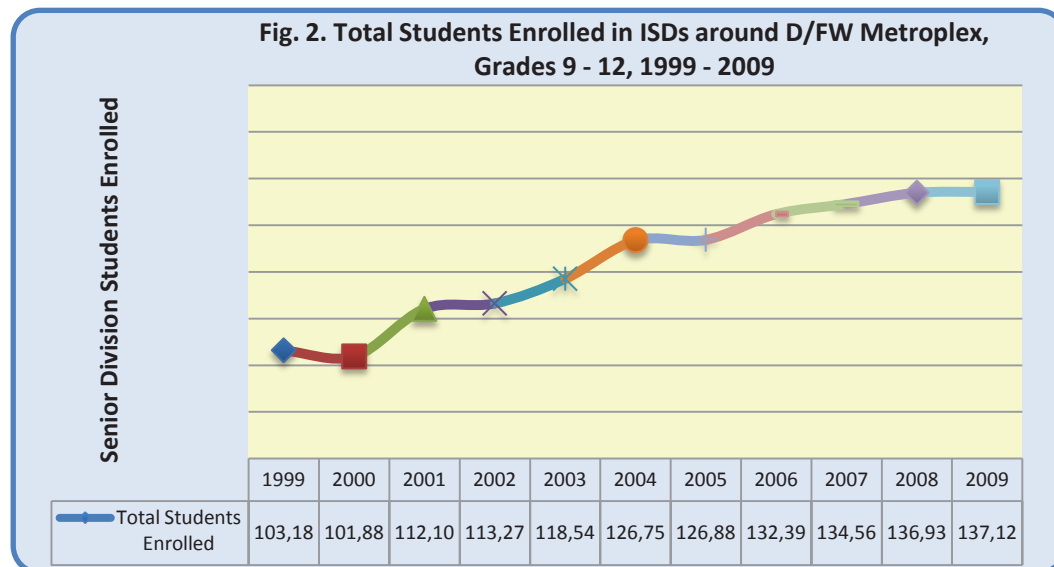
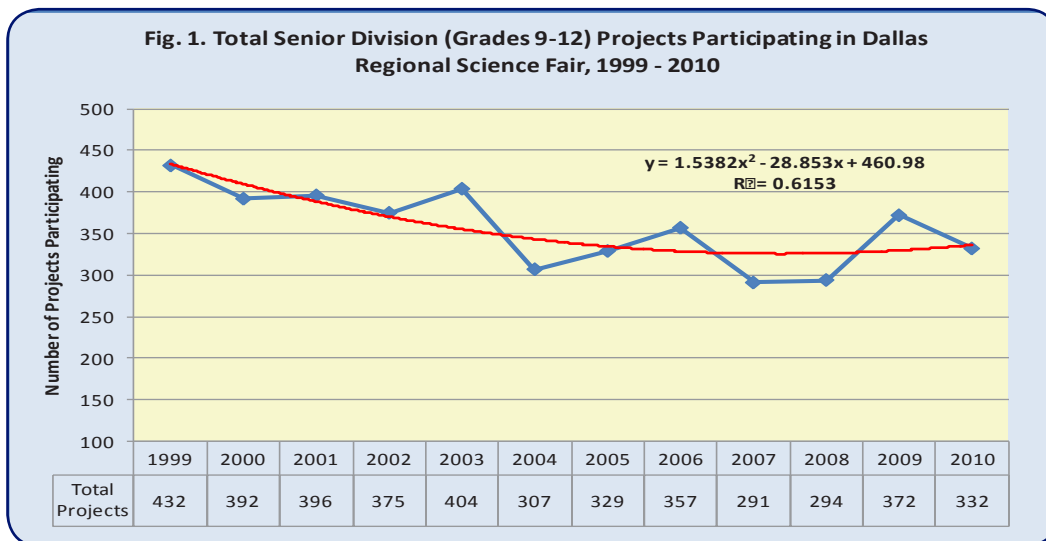
DRSEF comprises 20 Dallas-area cities registered to exhibit projects (<http://www.dallassciencefair.org/about/>). Data from DRSEF at the individual and science-category level were obtained from the Fair President, Dr. Simon Dalley of Southern Methodist University (SMU), Dallas, TX (4). Using the data at this stage of the science-fair competitions allows us to compare the participation from and competitiveness of different independent school districts, charter schools and other private schools from 20 cities of DFW Metroplex that make up the Dallas regional-level competition. DRSEF data collected were aggregated to three levels - ISD, division and science-category - for comparative purposes. Longer-horizon participation data (1999 – 2010, 12-year period) was available only for senior-division; junior-division participation data was available for only the last four years (2007 – 2010). Most of the trend analyses and ISD comparisons (junior vs. senior divisions and physical vs. life categories), therefore, were focused on 2007 – 2010 data. Annual student-enrollment data were obtained from Texas Education Agency (TEA), Austin, TX (5). The two data elements – science-fair participation data and student-enrollment data – were used in

the computation of metrics (see metrics definitions above) so that valid comparisons of ISDs could be made both at the division level and science-category level.

Analytical Findings

Overall senior-division science-fair participation trends (1999 – 2010)

The long-term trend on science-fair participation at the senior-division level is presented in Fig. 1. Although substantial year-to-year variation is discernible (blue line), there is a declining trend (red trend line) in general. Average number of project entries in the DRSEF senior division in the last six years (2005-2010) was 14% lower than that in the prior six years (1999-2004), while the average student enrollment increased 17% (Fig. 2) between 1999 and 2009 academic years.



NB: DRSEF data for 2010 in Fig 1 above corresponds to academic-year student enrollment data for 2009 in Fig 2 and so on.

The declining numbers of senior-level projects observed above can be explained, at least in part, by the significant reduction in DRSEF participation from two large ISDs, Richardson and Irving. Participation from other new ISDs such as Coppell, McKinney, Frisco, Cedar Hill, De Soto and Lancaster in the last four years was not enough to offset the declining trend. Evidently, the decline in participation at DRSEF is even steeper at the junior-level (trend data not available; Dr. S. Dalley, personal communication).

ISDs’ participation trends by division in the last four years (2007 – 2010)

Plano ISD has consistently had the lion’s share of projects participating in DRSEF in both junior and senior divisions, followed by Dallas ISD (Table 1). It is important to note that Coppell and McKinney ISDs have steadily increased their share of participating projects at DRSEF over the last four years, surpassing Garland ISD in the last two years. Also significant to note is that Dallas ISD whose participation at the fair has been decreasing since 2007 has rebounded back in 2010, with a total of 113 projects, majority of which (65%) was at the junior-division.

Table 1. Number of Science Project Entries by Division at the Dallas Regional Science and Engineering Fair (2007 - 2010).

| School District | 2007 | | | 2008 | | | 2009 | | | 2010 | | |
|-----------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | Junior | Senior | Total-2007 | Junior | Senior | Total-2008 | Junior | Senior | Total-2009 | Junior | Senior | Total-2010 |
| Allen ISD | 6 | 1 | 7 | 11 | 2 | 13 | 10 | 1 | 11 | 6 | 1 | 7 |
| Carrollton-Farmers Branch ISD | 20 | 14 | 34 | 12 | 16 | 28 | 4 | 17 | 21 | 4 | 21 | 25 |
| Cedar Hill ISD | 0 | 0 | 0 | 3 | 2 | 5 | 6 | 11 | 17 | 8 | 9 | 17 |
| Coppell ISD | 12 | 15 | 27 | 24 | 14 | 38 | 29 | 27 | 56 | 27 | 23 | 50 |
| Dallas Diocese | 9 | 21 | 30 | 0 | 21 | 21 | 4 | 16 | 20 | 0 | 0 | 0 |
| Dallas ISD | 69 | 51 | 120 | 58 | 49 | 107 | 38 | 40 | 78 | 73 | 40 | 113 |
| De Soto ISD | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 9 | 0 | 0 | 0 |
| Frisco ISD | 0 | 0 | 0 | 11 | 0 | 11 | 10 | 1 | 11 | 9 | 1 | 10 |
| Garland ISD | 39 | 21 | 60 | 27 | 24 | 51 | 17 | 33 | 50 | 16 | 26 | 42 |
| Harmony Science Academy (Charter) | 19 | 20 | 39 | 12 | 19 | 31 | 18 | 28 | 46 | 13 | 18 | 31 |
| Irving ISD | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 |
| Kemp ISD | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lancaster ISD | 0 | 8 | 8 | 0 | 13 | 13 | 2 | 5 | 7 | 8 | 8 | 16 |
| McKinney ISD | 0 | 0 | 0 | 0 | 0 | 0 | 47 | 0 | 47 | 57 | 0 | 57 |
| Mesquite ISD | 22 | 9 | 31 | 12 | 0 | 12 | 9 | 0 | 9 | 4 | 2 | 6 |
| Plano ISD | 137 | 126 | 263 | 119 | 118 | 237 | 130 | 170 | 300 | 134 | 149 | 283 |
| Richardson ISD | 0 | 0 | 0 | 0 | 9 | 9 | 0 | 3 | 3 | 0 | 10 | 10 |
| Waxahachie ISD | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 2 | 2 |
| Other* | 7 | 4 | 11 | 3 | 7 | 10 | 4 | 7 | 11 | 17 | 22 | 39 |
| Grand Total | 340 | 291 | 631 | 292 | 294 | 586 | 328 | 372 | 700 | 376 | 332 | 708 |

*** Includes Home School System and Private Schools (county-specific or otherwise)**

ISDs' participation trends by science-category in the last three years (2007 – 2010)

Table 2 shows the most recent 4-year DFW area-ISDs participation trend in Physical vs. Life Sciences categories. Plano ISD, with the highest number of projects entering DRSEF in both Physical and Life sciences categories, had higher number of project entries in the Physical sciences category than in Life sciences category. By contrast, Dallas, Garland and McKinney, three other ISDs with significant number of participating projects – had more projects in Life sciences category than in Physical sciences. Coppell ISD participation was more evenly spread between the two science categories, except in 2009.

Table 2. Number of Science Project Entries by Category at the Dallas Regional Science and Engineering Fair (2007 - 2010).

| School District | 2007 | | | 2008 | | | 2009 | | | 2010 | | |
|-----------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | Life | Physical | Total-2007 | Life | Physical | Total-2008 | Life | Physical | Total-2009 | Life | Physical | Total-2010 |
| Allen ISD | 3 | 4 | 7 | 6 | 7 | 13 | 5 | 6 | 11 | 3 | 4 | 7 |
| Carrollton-Farmers Branch ISD | 14 | 20 | 34 | 6 | 22 | 28 | 9 | 12 | 21 | 9 | 16 | 25 |
| Cedar Hill ISD | 0 | 0 | 0 | 2 | 3 | 5 | 11 | 6 | 17 | 13 | 4 | 17 |
| Coppell ISD | 13 | 14 | 27 | 19 | 19 | 38 | 31 | 25 | 56 | 23 | 27 | 50 |
| Dallas Diocese | 16 | 14 | 30 | 19 | 2 | 21 | 9 | 11 | 20 | 0 | 0 | 0 |
| Dallas ISD | 84 | 36 | 120 | 69 | 38 | 107 | 46 | 32 | 78 | 68 | 45 | 113 |
| De Soto ISD | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 4 | 9 | 0 | 0 | 0 |
| Frisco ISD | 0 | 0 | 0 | 6 | 5 | 11 | 2 | 9 | 11 | 4 | 6 | 10 |
| Garland ISD | 38 | 22 | 60 | 31 | 20 | 51 | 29 | 21 | 50 | 29 | 13 | 42 |
| Harmony Science Academy (Charter) | 19 | 20 | 39 | 12 | 19 | 31 | 17 | 29 | 46 | 16 | 15 | 31 |
| Irving ISD | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 0 | 0 |
| Kemp ISD | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lancaster ISD | 4 | 4 | 8 | 11 | 2 | 13 | 3 | 4 | 7 | 9 | 7 | 16 |
| McKinney ISD | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 17 | 47 | 32 | 25 | 57 |
| Mesquite ISD | 14 | 17 | 31 | 5 | 7 | 12 | 2 | 7 | 9 | 3 | 3 | 6 |
| Plano ISD | 119 | 144 | 263 | 108 | 129 | 237 | 135 | 165 | 300 | 126 | 157 | 283 |
| Richardson ISD | 0 | 0 | 0 | 5 | 4 | 9 | 3 | 0 | 3 | 7 | 3 | 10 |
| Waxahachie ISD | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 1 | 1 | 2 |
| Other* | 5 | 6 | 11 | 5 | 5 | 10 | 10 | 1 | 11 | 21 | 18 | 39 |
| Grand Total | 330 | 301 | 631 | 304 | 282 | 586 | 348 | 352 | 700 | 364 | 344 | 708 |

*** Includes Home School System and Private Schools (county-specific or otherwise)**

ISDs’ participation relative to student enrollment in the last four years (2007 – 2010)

Among the major ISDs in the DFW Metroplex (Table 3), Plano ISD, with a share of 11.7% of the student enrollment had not only had the highest number of projects participating at the DRSEF (46.9% of total) but also the highest number of participation per 1000 students enrolled (11.61 PPT) in grades 7 – 12 that make up the combined junior and senior divisions of the Dallas regional-level competition. Dallas ISD accounted for 2nd highest number of participating projects, on an average, but ranks 8th in PPT, although it ranks first (30.0%) among the DFW area ISDs in the percent share of student enrollment.

Computation of a metric called Participation Index (PI) by normalizing the participation data with the student enrollment data (see definition above), allows us to compare the DRSEF participation of various ISDs on the same scale. Therefore, PI is a true reflection of ISD participation at the competitive DRSEF. Note that PI of 100 is an average participation; >100 is above-average, whereas <100 is below-average. Comparing the ISDs on this metric, it is evident that Plano ISD had the highest PI of 402 (over four times more likely than average in science-fair participation) followed by Coppell ISD (PI = 322, with 2.3% of the student-enrollment share), Lancaster ISD (PI = 143, with 1.3% of the student-enrollment share) and McKinney ISD (PI = 103 with 4.3% of total student enrollment) – the only four ISDs with above-average likelihood of DRSEF participation (Table 3). Among the 13 major ISDs included in the analysis, Dallas ISD with the largest student enrollment share - nearly a third of the total - ranked a distant 8th (PI = 60) and Garland ISD with the second-largest (12.6%) student enrollment ranked 7th (PI = 70), both with a below-average DRSEF participation.

Table 3. Comparison of Major ISDs in DFW Metroplex on Student Enrollment and Science-fair Participation Metrics (Combined Junior & Senior Division) over 2007 – 2010 period

| School District | Average Annual Student Enrollment | Share of Student Enrollment | Average Project Entries Per Year | % Total Participating Projects | Projects per 1000 Students Enrolled | Participation Index |
|-------------------------------|-----------------------------------|-----------------------------|----------------------------------|--------------------------------|-------------------------------------|---------------------|
| Plano ISD | 23,320 | 11.7% | 271 | 46.9% | 11.61 | 402 |
| Coppell ISD | 4,594 | 2.3% | 43 | 7.4% | 9.31 | 322 |
| Lancaster ISD | 2,656 | 1.3% | 11 | 1.9% | 4.14 | 143 |
| McKinney ISD | 8,635 | 4.3% | 26 | 4.5% | 2.98 | 103 |
| Cedar Hill ISD | 3,817 | 1.9% | 10 | 1.7% | 2.55 | 88 |
| Carrollton-Farmers Branch ISD | 11,223 | 5.6% | 27 | 4.7% | 2.41 | 83 |
| Garland ISD | 25,117 | 12.6% | 51 | 8.8% | 2.02 | 70 |
| Dallas ISD | 59,858 | 30.0% | 104 | 18.1% | 1.74 | 60 |
| Allen ISD | 7,299 | 3.7% | 10 | 1.6% | 1.30 | 45 |
| Mesquite ISD | 16,507 | 8.3% | 15 | 2.5% | 0.88 | 30 |
| Frisco ISD | 8,814 | 4.4% | 5 | 0.9% | 0.60 | 21 |
| Richardson ISD | 14,651 | 7.3% | 6 | 1.0% | 0.38 | 13 |
| Irving ISD | 13,336 | 6.7% | 1 | 0.1% | 0.04 | 1 |

Conclusion

If this study provides some supporting evidence to the widely prevailing perception that student-interest in science education in the United States may be declining, then there is a need to explore the subject further and understand what factors might be contributing to this decline. Based on the body of knowledge available to us so far (1, 2, 3) and current public and policy discussions/debate happening on Science issues around the country, it appears that a variety of factors – demographic, cultural and/or social – contributing either directly or acting in concert with other factors, may be responsible for the not-so-good state of affairs in the nation's science education today:

- Science curriculum
- An environment where the teaching of Science and Math may be perceived as burdensome
- Quality of teachers and science teaching
- Challenges in federal funding of education relative to other priorities
- Value placed by the general public on education vs. athletics

In spite of the prior evidence (1, 2, 3) and findings of this study suggesting that there has been a declining interest among U.S. students in science education, it is heartening to note that at least one of the contributing factors listed above may be changing for the better – funding for education, in general, and science education, in particular. President Obama has promised to increase funding for Science education. Similar to honoring winning athletes at the White House, President Obama hosted a White House Science Fair, the first ever, on Oct 18, 2010, that fulfills his promise of Educate to Innovate campaign he launched

in Nov 2009 to inspire boys and girls to excel in math and science. This is a welcome step, however symbolic it may be, in the Federal government's efforts to accord science the respect and the place it deserves and in boosting the morale of all those who are interested in working towards the betterment of science education in the United States.

In addition to the immediate implications of this study to the science education of DFW-area ISDs, what are the benefits of this study to society at large? An increased participation in science fair not only stimulates student interest in scientific inquiry and experimentation, but it also promotes (a) public awareness about current science issues and (b) a two-way dialogue and debate between scientists and society at the local level (6).

What can we do to promote DRSEF participation?

- Schools (science teachers) need to publicize better and reinforce the importance of student participation in science fairs, especially at the high-school level
- Make participation in science fairs or science research projects mandatory
- Offer extra credit to students for participation in science fairs or science research projects
- Have award winners at the science fair share their project findings and participation experiences at school general assembly – at their own schools as well as other area schools
- Encourage scientists engaged in research at the local universities and/or research institutes to share their scientific activities and/or act as mentors to budding scientists at schools

- Build and facilitate a culture of shared learning and interaction among area ISDs as it relates to science-fair competition, science education and scientific investigation at school level

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