The Issue

Powerpoints calculations are incorrect because all teams do not play the same number of games. Teams that play more games erroneously accumulate higher OpVPs & OpOpVPs. Teams that play fewer games are penalized rather heavily in their accumulation of those same values. Teams that play the standard number of games are nominally impacted. I can't count the number of times I have told people that the scheduled number of games does NOT matter, and that powerpoints correctly compensates for differences in the number of games….but I was totally wrong.

It boils down to this: The current AIA powerpoint formula (and mine, too) do not properly normalize points obtained from opponents via OpVPs and OpOpVPs. Normalization means to "conform to a standard or norm." The "norm" in this case is the standard number of games, for example soccer's "norm" is 12.

Here is a simplified representation of the powerpoint formula's points obtained from a SINGLE opponent:

PPnts = [f(VP) + f(OpVP) + f(OpOpVP)] / (#games played)

f(VP) is correctly calculated and there is not a problem for this value when teams play schedules different from the "norm"…but that covers only about half of the points awarded by the formula.

> **Note:** there is a SIDE issue regarding soccer VPs that my wife immediately saw. It is peripherally related to the current problem but is worth pointing out while on the subject. Soccer's VP value is INCONSISTENT with ALL other AIA sports VP values. All other sports use a value of five times the norm (5*norm). Football is (5*10 games=50), baseball/softball/basketball are (5*18 games=90), badminton/tennis are (5*14 games=70). To be consistent with other sports, winter soccer's value should be (5*12 games)=60 rather than 70. In other words, soccer's powerpoints emphasize the value of victories more than all the other sports (5.833*12 games=70).

f(OpVP) and f(OpOpVP): This "half" of the powerpoints formula is flawed in its implementation. The values are not standardized to the "norm" number of games. Instead of multiplying by the "norm" value in key parts of their calculations, they are multiplied by the (# of games played). This is the root cause of the error.

In fact, aside from the assigned value for VP (talked about in the Note above), the current AIA powerpoints implementation doesn't include the concept of the "norm" anywhere in the calculations. The calculations for all sports are done independently of the "norm" value for each sport (10,12,14,18). The "norm" value may be included somewhere as a variable or constant, but it is either unused or not used properly (perhaps divided/cancelled out). I know this because my implementation was exactly the same.

The result is that teams who do not play the normal schedule of games have dramatically inaccurate powerpoints.

Specific Implementation Error

Let me give a specific example of the implementation error. Below is a snippet of #1 Chaparral's powerpoint's mini-schedule for boy's soccer from the AIA powerpoint tables. Only two of Chaparral's eleven games are shown.

Chaparral High School

Soccer - Boy's (W) Division I - Section 3

Opponent	Date	#Games	Opp. Record	Opp. Classification	H/V	Result	Victory Points	Opp. Victory Points	Opp. Opp. Victory Points	Weighted Total
Westwood High School	11-29-11	1/1	3 - 9	Division I - Section 3	H	Win (4-1)	70	15.71	297.75	**56.96**
Brophy College Preparatory	12-01-11	1/1	11 - 1	Division I - Section 3	V	Win (1-2)	70	59.58	186.29	**71.13**

We can highlight the calculation error by looking at the Chaparral vs Brophy Opp Victory Points currently listed as 59.58. Chaparral played a 13-game schedule, one more than the "norm" and Brophy played a schedule of 12 D1 teams finishing with a record of (11-1).

The highlighted OPVP number is erroneously calculated in the AIA implementation as follows:
(5*#Brophy_wins/#Brophy_games)*(#Chaparral_games) = **(5 * 11/12) * 13 = 59.58**

The implementation error is the use of the multiplier **13**, the # of Chaparral games. The correct mathematical procedure for normalization of OPVPs requires that the multiplier be the "norm" value (which is "12" for soccer), NOT the # of Chaparral games.

= (5* 11/12) * **12** = **55** is the **corrected calculation**

EVERY opponent of Brophy should receive a value of 55 in that OPVP cell. It should not vary and should be independent of the # games played by Brophy's opponents.

Every other value in Chaparral's Opp Victory Points column has also been incorrectly calculated using a multiplier of 13 instead of the "norm" of 12. The OpOpVP column is similar, but more complicated, because there is a "hidden column of numbers" behind its creation that is not shown in this table…both that "hidden" column and the column shown here fail to use the "norm" as their multiplier. This results in Chaparral's final powerpoint number being significantly inflated, thereby giving them an unfair advantage over teams that played the normal 12 game schedule.

The effect on #2 Maryvale (not shown here), who had a game schedule of 14, is more pronounced. Errors in Maryvale's powerpoints are based on a multiplier of 14 versus what should have been the "norm" value of 12. Obviously errors increase as teams deviate further from the "norm" schedule.

Calculations by John Carrieres

Example: Impact on Final Boys D1 Soccer Rankings

The previous example showed the implementation error's impact for a single cell/team. The following table shows its impact on an entire division's rankings for one sport: Boys D1 Soccer (only the first 35 teams are shown). I corrected my powerpoint spreadsheet to use soccer's "norm" schedule value of 12 where it should be used.

Legend

Corrected Final Rank:	Final Rank WITH Powerpoints Calculations Corrected
Change from Posted:	Change from the AIA's Posted Final Rank
Corrected PP:	Final Powerpoints WITH Powerpoints Calculations Corrected
Posted PP:	AIAs Posted Final Powerpoints

[see next page…]

Corrected Final Rank	Team	Change from Posted	Corrected PP	Posted PP	Team Final Record
1	Chaparral	0	56.94	59.17	(12-1)
2	Gilbert	1	56.52	56.6	(12-0)
3	Hamilton	1	55.75	55.91	(10-2)
4	Brophy	2	55.01	55.15	(11-1)
5	Ironwood	0	54.97	55.22	(11-1)
6	Tucson	1	54.12	54.12	(11-1)
7	Tolleson	3	53.07	53.6	(9-3)
8	San_Luis	3	52.76	53.27	(10-2)
9	Maryvale	-7	52.25	57.18	(10-4)
10	Westview	3	52.21	52.21	(9-3)
11	Carl_Hayden	1	52.08	52.74	(10-2)
12	Chandler	-4	51.3	53.82	(9-4)
13	Alhambra	-4	51.03	53.63	(10-3)
14	Desert_Vista	0	50.89	50.99	(9-3)
15	MV_Mesa	0	49.89	49.89	(9-3)
16	Millennium	0	49.36	49.54	(8-4)
17	Pinnacle	1	48.95	49.25	(8-4)
18	O'Connor	2	48.9	49	(9-3)
19	Cibola	-2	48.72	49.39	(8-4)
20	Red_Mountain	1	48.15	48.5	(9-3)
21	Rincon	1	47.41	47.09	(8-4)
22	North_Canyon	-3	47.39	49.18	(10-3)
23	Perry	0	46.74	46.9	(8-4)
24	Basha	0	44.87	45.11	(6-6)
25	Highland	0	44.81	44.97	(7-5)
26	Desert_View	1	44.76	44.44	(7-5)
27	CoronaDelSol	-1	44.67	44.76	(7-5)
28	Kofa	0	42.68	43.19	(6-6)
29	ValleyVista	0	42.47	42.54	(6-6)
30	Dobson	1	41.59	41.75	(5-7)
31	North_High	-1	39.72	41.98	(6-7)
32	Central	0	39.52	39.8	(5-7)
33	Camelback	0	39.25	39.6	(5-7)
34	Buena	6	39.15	36.88	(4-7)
35	Mesa	-1	39.07	39.15	(5-7)

Calculations by John Carrieres

Notice that the teams whose schedule was different than the "norm" (12 games) are the teams whose PP values were impacted most. Teams that previously had the advantage (by scheduling more games) have moved down, some very significantly. An exception was #1 Chaparral whose powerpoint reduction still left them at #1. Only one team on this list was under-scheduled (Buena), and their final rank moved up appropriately.

The "good" news for this year's boys D1 is that no team missed the playoffs because of the problem. That was not the case in Boys D2 and D3 in which there were teams that missed the playoffs.

Example: Extreme Case using Existing Powerpoints Implementation

I like to use extreme examples to make a problem or issue very obvious. I tried a number of such cases just to convince myself that the problem I saw when adding the basketball playoff games was real.

[see next page…]

Let's use the final D1 Soccer Rankings as a starting point:

	FINAL AIA	PP	PR W-L	VP	OPVP	OPOPVP	Games	PP
1	Chaparral	59.17	(12-1)	840	389.3	3481.2	13	59.1738
2	Maryvale	57.18	(10-4)	700	586.0	3736.2	14	57.1802
3	Gilbert	56.60	(12-0)	840	244.2	2986.5	12	56.6026
4	Hamilton	55.91	(10-2)	700	418.1	2655.2	12	55.9079
5	Ironwood	55.22	(11-1)	770	304.0	2816.3	12	55.2182
6	Brophy	55.15	(11-1)	770	285.8	2963.4	12	55.1474
7	Tucson	54.12	(11-1)	770	280.0	2769.7	12	54.1237
8	Chandler	53.82	(9-4)	630	457.3	3577.5	13	53.8186
9	Alhambra	53.63	(10-3)	700	395.8	3381.2	13	53.6274
10	Tolleson	53.60	(9-3)	630	399.2	2970.4	12	53.5958
11	San_Luis	53.27	(10-2)	700	321.4	2893.1	12	53.2739
12	Carl_Hayden	52.74	(10-2)	700	299.8	2959.7	12	52.7405
13	Westview	52.21	(9-3)	630	385.0	2764.3	12	52.2054
14	Desert_Vista	50.99	(9-3)	630	357.6	2718.3	12	50.9870
15	MV_Mesa	49.89	(9-3)	630	329.0	2712.7	12	49.8902
16	Millennium	49.54	(8-4)	560	382.9	2844.4	12	49.5422
17	Cibola	49.39	(8-4)	560	370.8	2916.0	12	49.3870
18	Pinnacle	49.25	(8-4)	560	400.8	2613.4	12	49.2513
19	North_Canyon	49.18	(10-3)	700	270.0	3357.8	13	49.1838
20	O'Connor	49.00	(9-3)	630	322.3	2558.7	12	48.9976
21	Red_Mountain	48.50	(9-3)	630	255.3	3041.2	12	48.4961
22	Rincon	47.09	(8-4)	560	337.3	2665.9	12	47.0890
23	Perry	46.90	(8-4)	560	293.5	3015.7	12	46.9035
24	Basha	45.11	(6-6)	420	437.3	2690.9	12	45.1112
25	Highland	44.97	(7-5)	490	348.5	2757.2	12	44.9724

We are going to add two games into the game schedule involving two teams who just missed the playoffs: Pinnacle beats Cibola, Cibola beats Pinnacle. My expectation would be that these two teams' powerpoints (with high winning percentages of about .67) will be hurt by losing one and winning one.

Calculations by John Carrieres

These two teams now have the same number of games as Maryvale (14 - two games above the "norm"). Here is the result:

	AIA Variation #1	PP	PR W-L	VP	OPVP	OPOPVP	Games	PP
1	Chaparral	59.42	(12-1)	840	386.2	3574.0	13	59.4238
2	Maryvale	57.17	(10-4)	700	586.0	3733.2	14	57.1695
3	Gilbert	56.60	(12-0)	840	244.2	2986.5	12	56.6026
4	Hamilton	55.90	(10-2)	700	418.1	2652.6	12	55.8972
5	Ironwood	55.20	(11-1)	770	304.0	2812.0	12	55.2004
6	Brophy	55.12	(11-1)	770	285.8	2956.6	12	55.1188
7	Tucson	54.12	(11-1)	770	280.0	2768.0	12	54.1165
8	Chandler	53.96	(9-4)	630	455.7	3627.6	13	53.9579
9	Alhambra	53.76	(10-3)	700	394.2	3429.4	13	53.7595
10	Cibola	53.76	(9-5)	630	522.6	4049.0	14	53.7576
11	Tolleson	53.60	(9-3)	630	399.2	2970.4	12	53.5958
12	Pinnacle	53.50	(9-5)	630	557.6	3663.0	14	53.5038
13	San_Luis	53.50	(10-2)	700	318.5	2971.9	12	53.4953
14	Carl_Hayden	52.73	(10-2)	700	299.8	2958.0	12	52.7334
15	Westview	52.21	(9-3)	630	385.0	2764.3	12	52.2054
16	Desert_Vista	50.98	(9-3)	630	357.6	2716.6	12	50.9798
17	MV_Mesa	49.88	(9-3)	630	329.0	2709.2	12	49.8760
18	Millennium	49.54	(8-4)	560	382.9	2844.4	12	49.5422
19	North_Canyon	49.43	(10-3)	700	266.9	3448.8	13	49.4267
20	O'Connor	49.26	(9-3)	630	319.5	2647.8	12	49.2619
21	Red_Mountain	48.50	(9-3)	630	255.3	3041.2	12	48.4961
22	Rincon	47.09	(8-4)	560	337.3	2665.9	12	47.0890
23	Perry	46.90	(8-4)	560	293.5	3015.7	12	46.9035
24	Basha	45.10	(6-6)	420	437.3	2687.5	12	45.0970
25	Highland	44.97	(7-5)	490	348.5	2757.2	12	44.9724

Obviously a problem, as both teams now make the playoffs and have actually increased their powerpoints significantly. Let's carry this a step further. I know that teams are not allowed to schedule this many games…but I have told many people (as has the AIA) that the powerpoint calculations correctly normalize powerpoints to the number of games played. I truly believed that scheduling fewer/more games or cancelling a game did not impact their accuracy.

Calculations by John Carrieres

So, let's add four more games into the game database: two more wins by Pinnacle against Cibola and two more wins by Cibola against Pinnacle. They play each other a total of six times. Here is the output:

	AIA Variation #2	PP	PR W-L	VP	OPVP	OPOPVP	Games	PP
1	Cibola	64.82	(11-7)	770	886.2	7660.1	18	64.8208
2	Pinnacle	64.33	(11-7)	770	931.2	7078.8	18	64.3312
3	Chaparral	59.96	(12-1)	840	382.1	3749.8	13	59.9571
4	Maryvale	57.16	(10-4)	700	586.0	3729.2	14	57.1552
5	Gilbert	56.60	(12-0)	840	244.2	2986.5	12	56.6026
6	Hamilton	55.88	(10-2)	700	418.1	2649.2	12	55.8829
7	Ironwood	55.18	(11-1)	770	304.0	2806.3	12	55.1766
8	Brophy	55.08	(11-1)	770	285.8	2947.4	12	55.0807
9	Chandler	54.24	(9-4)	630	453.7	3720.5	13	54.2436
10	Tucson	54.11	(11-1)	770	280.0	2765.7	12	54.1070
11	Alhambra	54.04	(10-3)	700	392.2	3519.8	13	54.0357
12	San_Luis	53.99	(10-2)	700	314.7	3125.1	12	53.9905
13	Tolleson	53.60	(9-3)	630	399.2	2970.4	12	53.5958
14	Carl_Hayden	52.72	(10-2)	700	299.8	2955.7	12	52.7239
15	Westview	52.21	(9-3)	630	385.0	2764.3	12	52.2054
16	Desert_Vista	50.97	(9-3)	630	357.6	2714.3	12	50.9703
17	North_Canyon	49.95	(10-3)	700	262.8	3622.1	13	49.9505
18	MV_Mesa	49.86	(9-3)	630	329.0	2704.7	12	49.8569
19	O'Connor	49.81	(9-3)	630	315.6	2814.7	12	49.8143
20	Millennium	49.54	(8-4)	560	382.9	2844.4	12	49.5422
21	Red_Mountain	48.50	(9-3)	630	255.3	3041.2	12	48.4961
22	Rincon	47.09	(8-4)	560	337.3	2665.9	12	47.0890
23	Perry	46.90	(8-4)	560	293.5	3015.7	12	46.9035
24	Basha	45.08	(6-6)	420	437.3	2682.9	12	45.0779
25	Highland	44.97	(7-5)	490	348.5	2757.2	12	44.9724

Cibola and Pinnacle are now the top two seeds in the tourney with records of (11-7). Looking at the data it is clear that the OPVP & OPOPVP are going astronomical, but the VP values are correct.

Calculations by John Carrieres

FINALLY, let's run this last example (Cibola and Pinnacle play each other an additional 6 times) with the corrected powerpoints formula:

	CORRECTED Variation #2	PP	PR W-L	VP	OPVP	OPOPVP	Games	PP
1	Chaparral	56.70	(12-1)	840	352.7	3168.7	13	56.7046
2	Gilbert	56.52	(12-0)	840	244.2	2966.6	12	56.5195
3	Hamilton	55.72	(10-2)	700	418.1	2610.5	12	55.7218
4	Brophy	54.94	(11-1)	770	285.8	2914.9	12	54.9450
5	Ironwood	54.93	(11-1)	770	304.0	2746.5	12	54.9275
6	Tucson	54.11	(11-1)	770	280.0	2765.7	12	54.1070
7	Tolleson	53.07	(9-3)	630	399.2	2843.3	12	53.0662
8	San_Luis	52.49	(10-2)	700	314.7	2764.2	12	52.4871
9	Maryvale	52.23	(10-4)	700	502.3	3102.7	14	52.2268
10	Westview	52.21	(9-3)	630	385.0	2764.3	12	52.2054
11	Carl_Hayden	52.06	(10-2)	700	299.8	2797.4	12	52.0642
12	Chandler	51.23	(9-4)	630	418.8	3251.3	13	51.2311
13	Alhambra	50.95	(10-3)	700	362.0	2989.5	13	50.9516
14	Desert_Vista	50.88	(9-3)	630	357.6	2692.1	12	50.8780
15	MV_Mesa	49.86	(9-3)	630	329.0	2704.7	12	49.8569
16	Millennium	49.36	(8-4)	560	382.9	2801.4	12	49.3628
17	O'Connor	48.69	(9-3)	630	315.6	2544.0	12	48.6864
18	Red_Mountain	48.15	(9-3)	630	255.3	2958.3	12	48.1506
19	Cibola	47.84	(11-7)	770	590.8	4203.8	18	47.8354
20	Pinnacle	47.83	(11-7)	770	620.8	3930.9	18	47.8272
21	Rincon	47.41	(8-4)	560	337.3	2742.5	12	47.4081
22	North_Canyon	47.15	(10-3)	700	242.6	3075.0	13	47.1463
23	Perry	46.74	(8-4)	560	293.5	2975.8	12	46.7374
24	Basha	44.83	(6-6)	420	437.3	2624.3	12	44.8338
25	Highland	44.81	(7-5)	490	348.5	2717.4	12	44.8063

Both move down to what looks like appropriate spots. OPVPs and OPOPVPs are high (as a result of the 18 game schedule), but when divided by the # games in the final powerpoints step are appropriate.

Calculations by John Carrieres

Example: Extreme Case #2 using Existing Powerpoints Formula

This one is actually not that extreme.

Once again, let's use the final D1 Soccer Rankings and game database as a starting point

	FINAL AIA	PP	PR W-L	VP	OPVP	OPOPVP	Games	PP
1	Chaparral	59.17	(12-1)	840	389.3	3481.2	13	59.1738
2	Maryvale	57.18	(10-4)	700	586.0	3736.2	14	57.1802
3	Gilbert	56.60	(12-0)	840	244.2	2986.5	12	56.6026
4	Hamilton	55.91	(10-2)	700	418.1	2655.2	12	55.9079
5	Ironwood	55.22	(11-1)	770	304.0	2816.3	12	55.2182
6	Brophy	55.15	(11-1)	770	285.8	2963.4	12	55.1474
7	Tucson	54.12	(11-1)	770	280.0	2769.7	12	54.1237
8	Chandler	53.82	(9-4)	630	457.3	3577.5	13	53.8186
9	Alhambra	53.63	(10-3)	700	395.8	3381.2	13	53.6274
10	Tolleson	53.60	(9-3)	630	399.2	2970.4	12	53.5958
11	San_Luis	53.27	(10-2)	700	321.4	2893.1	12	53.2739
12	Carl_Hayden	52.74	(10-2)	700	299.8	2959.7	12	52.7405

We are going to add 5 games to Chaparral's schedule…all losses against the current #5-#9 teams in the final AIA powerpoints rankings. Here is the result:

	AIA Variation	PP	PR W-L	VP	OPVP	OPOPVP	Games	PP
1	Chaparral	63.74	(12-6)	840	924.5	6224.8	18	63.7359
2	Ironwood	58.58	(12-1)	840	373.8	3467.6	13	58.5820
3	Brophy	58.42	(12-1)	840	319.6	3913.6	13	58.4226
4	Maryvale	57.74	(10-4)	700	590.3	3853.2	14	57.7361
5	Chandler	57.72	(10-4)	700	539.1	4308.4	14	57.7155
6	Tucson	57.41	(12-1)	840	346.7	3406.7	13	57.4102
7	Alhambra	57.36	(11-3)	770	473.3	4099.6	14	57.3556
8	Gilbert	56.64	(12-0)	840	244.2	2994.5	12	56.6355
9	Hamilton	56.22	(10-2)	700	420.7	2706.8	12	56.2219
10	Tolleson	53.66	(9-3)	630	399.6	2983.1	12	53.6633
11	San_Luis	53.29	(10-2)	700	321.4	2897.0	12	53.2903
12	Carl_Hayden	52.72	(10-2)	700	299.8	2954.4	12	52.7184

Chaparral stays on top despite the additional five losses. They even have increased their powerpoints value. Once again, Chap's OPVPs and OPOPVPs are going crazy with a schedule of 6 games over the "norm" of 12 games.

Calculations by John Carrieres

Finally, let's run this last example again (5 additional Chaparral losses) on the corrected formula:

	CORRECTED Variation	PP	PR W-L	VP	OPVP	OPOPVP	Games	PP
1	Gilbert	56.55	(12-0)	840	244.2	2974.5	12	56.5525
2	Hamilton	55.89	(10-2)	700	420.7	2627.6	12	55.8918
3	Ironwood	55.79	(12-1)	840	345.0	2999.4	13	55.7861
4	Tucson	55.01	(12-1)	840	320.0	3021.3	13	55.0051
5	Brophy	54.99	(12-1)	840	295.0	3242.7	13	54.9913
6	Tolleson	53.07	(9-3)	630	399.6	2841.5	12	53.0732
7	San_Luis	52.77	(10-2)	700	321.4	2773.3	12	52.7749
8	Maryvale	52.47	(10-4)	700	506.0	3136.5	14	52.4656
9	Chandler	52.37	(10-4)	700	462.1	3505.7	14	52.3731
10	Westview	52.22	(9-3)	630	385.0	2766.6	12	52.2150
11	Alhambra	52.09	(11-3)	770	405.7	3233.3	14	52.0884
12	Carl_Hayden	52.05	(10-2)	700	299.8	2795.1	12	52.0546
13	Desert_Vista	51.04	(9-3)	630	360.3	2707.6	12	51.0416
14	Chaparral	49.74	(12-6)	840	616.3	3960.8	18	49.7433
15	MV_Mesa	49.59	(9-3)	630	329.0	2640.4	12	49.5891
16	Millennium	49.38	(8-4)	560	382.9	2805.6	12	49.3803
17	Cibola	48.85	(8-4)	560	373.1	2766.1	12	48.8492
18	O'Connor	48.81	(9-3)	630	322.7	2510.9	12	48.8130

Chaparral's final spot is much more appropriate given the (12-6) record. This is the way powerpoints is supposed to work.

When the first round of section tournament basketball games are completed, most all those teams will increase their powerpoints, even those that lose. Teams on the bubble who did not make the sectionals (waiting to see if they qualify for the state tourney) will be at a disadvantage: they don't have that "extra" game to go into the calculations. An inordinate number of section tournament teams would advance to the state tournaments.

At first glance, most past tournament brackets for all sports are affected as well. Football this year was impacted and volleyball was impacted as well. Soccer (fall & winter) were impacted. Last year's results are much worse for all the sports. All the spring sports will be impacted as well. Even if all teams for a given sport start out with a "norm" schedule (same number of games), there are going to be cancellations which would cause the issue to resurface.

Calculations by John Carrieres