Allocating Undecided Voters in Pre-election Polling

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Abstract

Is there a way to make pre-election polls more accurate? This paper seeks to test some of the most popular methods of allocating 'undecided' voters, based on the underlying theory that the allocation of undecided voters will improve the public's expectations of election results and a pollster's claims about accuracy. Polling literature states the most popular methods to incorporate undecided voters include asking a "leaner" question that follows a ballot test question, or allocating the undecided proportionally to their vote preference. Both methods were used in this study, along with a third option in which an even-allocation, or essentially no allocation of undecided voters, took place. The study incorporates n=54 pre-election polls conducted in 20 different states, between October 26 and November 4, 2018, which were used to compare the three allocation methods. This includes an Absolute Error test (deviation between poll results and election results, Mosteller et al., 1949), a Statistical Accuracy test (absolute error compared with the poll's margin of error, Kimball, 2017), and a Predictive Accuracy test (did the poll predict the actual election winner?). The study found no significant difference between the accuracy of the polls that included an allocation of undecided voters as compared to those that did not (χ^2 (2, N=161)=.200, p =.905), suggesting that allocating undecided voters does not detract from, nor add to the reliability and validity of a pre-election poll.

Literature review

In 2016, the world watched the Brexit vote in the UK, where a sizable majority of opinion polls had the "Remain" side winning, albeit narrowly. Yet,on election night pundits were shocked to see the "Leave" side win by a solid 4% (Upton, 2016). In the U.S. Presidential election of 2016, the predominant opinion was that polls had a substandard performance (Mercer, et al, 2016). In 2017, for the third time in a row in the UK, all the major polls (except YouGov) were wrong when predicting the results of a national election. Most polls, projections and predictions showed Theresa May's Conservative Party gaining seats; instead she lost her parliamentary majority (Enten and Silver, 2017).

In Australia, (date) every major poll conducted over the course of almost three years predicted that the center-left Labor Party led by Bill Shorten would beat the incumbent Coalition government, Nonetheless, on election day, Prime Minister Scott Morrison was actually able to gain votes and seats, as compared to the last election in 2016. Polling

is usually accurate in Australia, where voting is mandatory. Given these instances, the results were particularly shocking (True, 2019)

In India, polls predicted a close race and perhaps even a hung parliament, but incumbent nationalist Narendra Modi was able to actually increase his party's majority to an almost unprecedented level (Patnaik, 2019).

These examples demonstrate the need for survey methodologists to improve pre-election polls accuracy. Why are polls often so far off in their predictions?

A pre-election poll is judged by how closely it comes to mirroring the actual results of an election, and some researchers suggest that polls with a high number of undecided voters produce invalid results. (Daves and Warden, 1993).

Since the modern pre-election polls were created in the 1930s, there has been an ongoing argument in the world of political polling about what to do with undecided voters (Crossley, 1940; Perry 1960; Fenwick, et al, 1982; Flannelly, et al, 2000).

Warren Mitofsky[1] (1998) argued in favor of the allocation of undecided voters:

> Footnote 2 (p.236) Mitofsky states, "*I (Mitofsky) would like to acknowledge that I made the mistake of not allocating the undecided during the 15 years I directed the CBS/New York Times Poll. I now believe that it is unreasonable of a pollster to ask a reader or viewer of a final preelection poll to make an interpretation about how the undecided will vote. A poll is being reported so the public knows what to expect when the election takes place. Leaving the undecided in the base of the percentages reported does not serve the public's' expectation or the pollsters' claims about accuracy."*

If Mitofsky is correct - that the allocation of undecided voters will improve the public's expectations of election results - as well as a pollster's claims about accuracy, the question becomes: What is the best method to allocate undecided voters?

Allocation Methods

There are a variety of methods that have been studied on this topic, including using party affiliation to place undecided voters into the choice of their party's candidate. This method assumes independents will stay as undecided. Another technique is looking at voters' ranking of candidates' name recognition; those who have a favorable opinion of only one of the candidates will be allocated to the group supporting that candidate (Crespi,1988). Still other researchers have focused on the salient issues, and maintain

[1] Warren Mitofsky, the first sentence in his *New York Times* obituary sums him up well: "Warren J. Mitofsky, an innovator and standard-setter in the polling industry for four decades" (Clymer, 2006).

that how the voter agrees or disagrees is an indicator that the voter will vote for the candidate with whom they agree on their most important issues (Fenwick, et al, 1982).

This study examines the three most popular methods prevalent in the literature, including (1) even-allocation resulting in no difference in the magnitude between the candidates, (2) proportionate re-allocation of the undecided vote based on the vote totals and (3) use of a "leaner question". Each method is described in more detail below.

1- No Allocation simply splits evenly the undecided vote in half and then allocates that vote to the top two candidates. For example, if a candidate is leading 50% to 40%, and 10% were undecided, that 10% would be allocated evenly: he allocation would be 5% for each candidate - making the published poll results 55% to 45%. (Martin et al., 2005; Bon et al., 2018). This essentially would do nothing to change the magnitude of the difference between the candidates, and as such, is used as our benchmark poll number.

2- Proportional Allocation focuses on undecided voters as unlikely voters, and recalculates the totals without them, essentially splitting the undecided vote proportionally to the poll results. Using the above example, if a candidate is leading 50% to 40%, and 10% were undecided, that 10% would be allocated 5.55% to the leading candidate (55.55%) and 4.45% for the other candidate, bringing their vote total to 44.45% making the difference 11 percentage points. (Crespi, 1988; Crespi, Fenwick, et al, 1982).

3- The Leaner technique is most popular and issued two-thirds of the time in addressing undecided voters. (Crespi, 1988). In this method, a poll will use a follow-up to the ballot test question, and ask who the undecided voters are leaning towards regarding particular candidates. This method was introduced by Perry in 1960 (Perry, 1960).

Poll Accuracy Metrics

Three metrics were used to compare the polls that included the three methods described above on how to handle undecided voters.

1- The absolute error metric was one created by Frederick Mosteller in 1949, as a result of the Truman v. Dewey polling debacle. Mosteller, was one of the authors of the report on what went wrong with such polls. Mosteller argued in favor of using the absolute error, which examines the difference between the poll results and the actual results (Mosteller, et al, 1949). The difference between these two differences is the absolute error. This is Mitosfky's preferred method of measuring a poll's accuracy (Mitosfky,1998).

As a benchmark to compare, the research in this study relies on data published by CNN contributor Henry Enten (2018), who used nonpartisan polls from 1998-2016 to find the absolute error to compare with the current findings from this study. Enten's

research found that House polls absolute error was on average 5.9 percentage points from actual results; U.S. Senate polls had an absolute error of 5.2 percentage points; and Governor polls had an absolute error average 5.1 percentage points (Enten, 2018).

2- The second metric used is statistical accuracy (*SA*) (Kimball, 2017), *SA* is designed to assess pre-election poll accuracy by extending the absolute error metric to include the poll's margin of error as part of the analysis. This test compares the variance between three differences, where the first difference is the estimate of the vote for the two leading candidates from a poll, the second difference is the election result for the same two candidates (just like Mosteller), and the third difference is the magnitude of the deviation when compared to the poll's margin of error. Here is the formula

SA if, *Poll Margin (r1 – d1) minus Vote Margin (R2 - D2) ≤ (MOE x 2)*

The first calculation is the typical measurement of which the public is most aware; a news report might have Candidate A leading by five points, and the public expectation follows that Candidate A will win by five points, regardless if the outcome was 52% to 47% or 45% to 40%. The next calculation is the difference in the actual vote margin, where Candidate A wins the election with 55% of the vote to 45% for Candidate B. The last number you will need is the sample size or the margin of error. In this scenario, we will use n=1,000 and a margin of error of +/- 3 percentage points. Plugging these numbers into the formula would look like this:

Poll Margin (52% – 47%) minus Vote Margin (55% - 45%) ≤ (3% x 2)

Poll Margin (5%) minus Vote Margin (10%) ≤ (6%)

5% ≤ 6%

Since 5% is less than or equal to 6%, the poll results fall within the range of scores statistically required to perform within to make it *SA*. Had the poll used a larger sample size and had a +/-2 percentage point margin of error, it would not have been *SA* (5% is greater than 4%). We would expect that 95% of polls should be *SA* based on the confidence level that is used.

3- The third metric used is a predictive accuracy test to examine whether the allocation of undecided voters would project the winner in a close contest. If a poll has a candidate winning 51% to 49%, and that candidate ends up losing by 1 point 49.5% to 50.5%, the absolute error would be 3 points. A poll with a margin of error of 2 percentage points would be statistically accurate, and the poll would have performed as it was intended to do. However the public expectation, as erroneous as it might be, is that the poll should project the winner. As such, this metric is included for

purposes of analysis, yet greater weight should be given to the first two metrics described above.

Research Question

This study investigates whether any difference exists between accuracy of pre-election poll estimates compared with actual election results under the following conditions:

(1) There is no allocation of undecided voters (i.e. same as even allocation),

(2) Allocation of undecided voters is done proportionally, based on the vote of the top two candidates (proportional allocation), or

(3) Allocating voters based on a follow-up, forced choice "lean" question (leaners).

Three tests will be applied to answer the research question. First, an absolute error test will be conducted to test hypothesis 1 using a multiple comparison test with a one-way Analysis of Variance (ANOVA).

Hypothesis 1 There is no difference in the absolute error between pre-election polls that allocate undecided voters using leaners, and pre-election polls that do not allocate undecided voters, or allocate undecided voters proportionately.

For hypothesis 2, a chi-square test for Association and Homogeneity, and a Proportion study using normal approximation is utilized, all with a significance level at $p < .05$ and a 95% confidence interval.

Hypothesis 2 There is no difference in the Statistical Accuracy between pre-election polls that allocate undecided voters using leaners, and those that do not allocate undecided voters, and polls that allocate undecided voters proportionately.

Next, a chi-square test for Association and Homogeneity will be calculated to compare the three methods with a significance level at $p < .05$ and a 95% confidence interval.

Hypothesis 3 There is no difference in the Predictive Accuracy between pre-election polls that allocate undecided voters using leaners, and those that do not allocate undecided voters, and polls that allocate undecided voters proportionately.

Methodology

To conduct this study the use of method 2, the "leaner" question, was incorporated into n=54 pre-election polls conducted in 20 different states between October 26 and November 4, 2018. The polls looked at n=23 congressional races, n=17 Governor Races, and 14 US Senate races.

Below is a sample ballot test question and a follow up "leaner" question which were used among other questions in the poll.

1. If the election for U.S. Senate were held today, for whom would you vote or lean towards voting among the following candidates?
Press 1 for Republican Ted Cruz (Q3)
Press 2 for Democrat Beto O'Rourke(Q3)
Press 3 for Libertarian Neal Dikeman (Q3)
Press 4 for undecided (Q2)

2. I understand that you are undecided, but towards whom are you currently leaning towards voting?
Press 1 for Republican Ted Cruz
Press 2 for Democrat Beto O'Rourke
Press 3 for Libertarian Neal Dikeman

Data was collected by Emerson College Polling using a mixed mode sample of IVR (Interactive Voice Recognition, also known as auto polls or robo polls) and online panels provided by SSI (recently acquired by Dynata), and Amazon Mechanical Turk. All polls were publicly published and are available on *Real Clear Politics* and *Fivethrityeight.com.*

Results

Hypothesis 1: Absolute Error Test

- Overall average absolute error with no allocation was 3.9 points
  - The range was between .1% and 21.9%

- Overall average absolute error with proportional allocation was 3.7 points
  - The range was between .1% and 19.7%

- Overall average absolute error with leaners was 3.9 points
  - The range was between .1% and 22.1%

	Overall Absolute Error	US House Polls	US Senate Polls	Governor Polls
No Allocation	3.9 points	5.5 points	2.7 points	2.6 points
Proportional Allocation	3.7 points	5.2 points	2.4 points	2.7 points
Leaners	3.9 points	5.6 points	2.8 points	2.5 points
Historical Average		5.9 points	5.2 points	5.1 points
Average Sample Size		N=353	N=788	N=832

This research question was designed to determine if there was a significant difference in the deviation of polls, and how undecided voters were allocated. A one-way Analysis of Variance (ANOVA) was calculated using the allocation method as the independent variable, and the deviation amount as the dependent variable. The test was not significant overall or within each of the three subsets (i.e. U.S. House polls, U.S. Senate Polls, Governor Polls):

- Overall Absolute Error was not significant $F(2,158) = .06$, $p = .946$
  - U.S. House Polls was not significant $F(2,66) = .04$, $p = .965$
  - U.S. Senate Polls was not significant $F(2,47) = .02$, $p=.981$

- Governor Polls was not significant $F(2,39) = .17$, $p=.843$

Hypothesis 2: Statistical Accuracy Test

When undecided voters were not allocated, 92.6% of pre-election polls were *SA*; when proportional allocation was used, SA was 94.4%; and, when "leaners" were included the SA was 94.3%. A chi-square test of independence was conducted, and the results concluded that the three methods are independent, meaning they are not significantly different from each other, χ^2 (2, N=161)=.200, p =.905 and are homogeneous with respect to their responses (figure xx). Cramér's phi was .04, which indicates that allocation method of undecided voters accounted for approximately .2% of the variability in the *SA* of pre-election polling.

A nonparametric binomial test was conducted to test whether the proportion of SA in polls with no allocation, proportional allocation, and leaners was within a presumed population value (proportion) of 95%. The non-allocation *SA* polls of 92.6% met our accuracy standard of .95 p = .285. The proportional-allocation *SA* polls of 94.4% met our accuracy standard of .95 p = .511. The leaner-allocation *SA* polls of 94.3% met our accuracy standard of .95 p = .498.

93% (50 out of 54) pre-election polls with no allocation were statistically accurate

- New Mexico had 3 of the 4 non SA polls
  - New Mexico District 1, with no allocation: The Democratic candidate won 59% v. 36.4% for the Republican (22.6-point difference). Polls had 51.4% for the Democrat and 41.4% for the Republican (10-point difference).
  - New Mexico District 3, with no allocation: The Democratic candidate won 63.3% v. 31.2% (32.1-point difference). Polls had Democratic candidate at 54.2% v. 37.2% (17-point difference).
  - New Mexico US Senate race, with no allocation: The Democratic candidate won 54% v. 30.6% (23.4-point difference). Polls had Democratic candidate at 48% v. 31.5% (16.5-point difference).
- Kansas district 1 was the fourth poll that was not SA
  - Kansas District 1, with no allocation: The Democratic candidate lost 31.6% v. 68.4% (36.8-point difference). Polls had 36.2% v. 51.1% (14.9-point difference).

- 96% (51 out of 54) pre-election polls with proportional allocation were statistically accurate
  - New Mexico had 2 of the 4 non SA polls
    - New Mexico District 1, with proportional allocation: The Democratic candidate won 59% v. 36.4% for the Republican (22.6-point difference). Polls had 55.4% for the Democrat and 44.6% for the Republican (10.8-point difference).

        - New Mexico District 3, with proportional allocation: The Democratic candidate won 63.3% v. 31.2% (32.1-point difference). Polls had Democratic candidate at 59.3% v. 40.7% (18.6-point difference).
    - Kansas District 1 was the third poll that was not SA
        - Kansas District 1, with proportional allocation: The Democratic candidate lost 31.6% v. 68.4% (36.8-point difference). Polls had Democratic candidate at 41.5% v. 58.5% (17.1-point difference).

- 94% (50 out of 53[2]) pre-election polls with leaners were statistically accurate
    - Similar to the results without leaners, Kansas District 1 and New Mexico District 3 were not SA
        - Kansas District 1, with leaners: The Democratic candidate lost 31.6% v. 68.4% (36.8-point difference). Polls had 37.7% v. 52.4% (14.7-point difference).
        - New Mexico District 3, with leaners: The Democratic candidate won 63.3% v. 31.2% (32.1-point difference). Polls had Democratic candidate at 55.3% v. 37.6% (17.7-point difference).
    - In South Dakota the At-large Congressional race was not SA
        - South Dakota At-large, with leaners: The Democratic candidate lost 36% v. 60.3% (24.3-point difference). Polls had Democratic candidate at 41% v. 55.9% (14.9-point difference).

Hypothesis 3: Predictive Accuracy Test

When undecided voters were not allocated, 92.6% of pre-election polls were *PA*. When proportional allocation was used, PA was 92.6%. When "leaners" were included, the PA was 90.6%. A chi-square test of independence was conducted and the results concluded that the three methods are independent, meaning they are not significantly different from each other, χ^2 (2, N=161)=.197, p =.906) and are homogeneous with respect to their responses (Appendix). Cramér's phi was .04, which indicates that allocation method of undecided voters accounted for approximately .2% of the variability in the *PA* of pre-election polling.

	US House Polls	US Senate Polls	Governor Polls
No Allocation	100% (23/23)	93% (13/14)	82% (14/17)
Proportional Allocation	100% (23/23)	93% (13/14)	82% (14/17)
Leaners	96% (22/23)	93% (13/14)	81%(13/16)

[2] The polls looked at n=23 congressional races, n=16 Governor Races and 14 US Senate races. In the state of Texas, the leaner question was only asked in the US Senate race and not in the gubernatorial race. The poll without leaners for Governor was included in the analysis, which accounts for the 1 unit difference between polls with leaners and those without leaners.

Historical Average	---	84%	84%

- 93% (50 out of 54) of pre-election polls with no allocation projected the winner. The outliers are listed below.
    - Florida US Senate: Poll had Democratic Candidate at 49.9% to 44.9% (5-point difference), actual results the Democratic Candidate 49.9% to 50.1% (0.2-point difference).
    - Florida Governor: Poll had Democratic Candidate at 50.9% to 45.6% (5.3-point difference), actual results the Democratic candidate 49.2% to 49.6% (0.4-point difference).
    - Kansas Governor: Poll had Democratic Candidate at 43% to 44.3% (1.3-point difference), actual results the Democratic candidate 47.8% to 43.3% (4.5-point difference).
    - Ohio Governor: Poll had Democratic Candidate at 49.3% to 45.8% (3.5-point difference), actual results the Democratic candidate 46.5% to 50.7% (4.3-point difference).

- 93% (50 out of 54) of pre-election polls with proportional allocation projected the winner. The outliers are listed below.
    - Florida US Senate: Poll had Democratic Candidate at 52.6% to 47.4% (5.3-point difference), actual results the Democratic Candidate 49.9% to 50.1% (0.2-point difference).
    - Florida Governor: Poll had Democratic Candidate at 52.7% to 47.3% (5.5-point difference), actual results the Democratic candidate 49.2% to 49.6% (0.4-point difference).
    - Kansas Governor: Poll had Democratic Candidate at 49.3% to 50.7% (1.5-point difference), actual results the Democratic candidate 47.8% to 43.3% (4.5-point difference).
    - Ohio Governor: Poll had Democratic Candidate at 51.8% to 48.2% (3.7-point difference), actual results the Democratic candidate 46.5% to 50.7% (4.3-point difference).

- 91% (48 out of 53) of pre-election polls with leaners projected the winning candidate. The outliers are listed below.
    - Florida US Senate: Poll had Democratic Candidate at 51.6% to 45.9% (5.7-point difference), actual results the Democratic Candidate 49.9% to 50.1% (0.2-point difference).
    - Florida Governor: Poll had Democratic Candidate at 52% to 45.9% (6.1-point difference), actual results the Democratic candidate 49.2% to 49.6% (0.4-point difference).
    - Kansas Governor: Poll had Democratic Candidate at 44.4% to 46.1% (1.7-point difference), actual results the Democratic candidate 47.8% to 43.3% (4.5-point difference).
    - Ohio Governor: Poll had Democratic Candidate at 50.2% to 47.6% (2.6-point difference), actual results the Democratic candidate 46.5% to 50.7% (4.3-point difference).

- New Mexico District 2: Poll had Democratic Candidate at 47.9% to 47.9% (0-point difference), actual results the Democratic candidate 50.7% to 49.3% (1.4-point difference).

Analysis

It appears the data supports rejecting null hypothesis 1 based on the Absolute Error test - polls with leaners only slightly performed better than the other two metrics in Governor polls (2.5), and 0.1 percentage point better than polls' without allocation. Other categories show "Leaners" increased the absolute error, and given our findings, it does not appear that leaners included in a pre-election poll lower the absolute error of the poll nor did the proportional allocation.

The data also rejects the null hypothesis 2, as there was no difference in *SA* performance of the three methods. Proportional allocation worked best at 96% *SA,* while leaners had a 94% *SA,* and no allocation had a 93% *SA*. There is a slight improvement using proportional and leaning allocations in pre-election polls, but not a significant difference based on the chi-square test.

The data also supports rejecting null hypothesis 3. Pre-election polls that allocate undecided voters using leaners had a lower predictive accuracy (91%) than pre-election polls that do not allocate undecided voters (93%), or allocate undecided voters proportionately (93%). There was no significant difference between the three allocation methods.

Discussion

Overall, there appeared to be a low number of undecided voters in the polls that were examined, which may have impacted the variability of the results. On average, the 54 polls had undecided voters making up 2.8 percentage points of the sample. The highest number of undecided voters was in the New Jersey Senate race (6.9%), Connecticut Senate race (6.7%), West Virginia Senate race (6.6%) and Texas Governor race (6.1%). No other poll had an undecided number higher that 5.7%, and the median number was 2.7 percentage points[3].

These numbers contrast with exit poll studies that have found 16% of voters make up their minds in the last 10 days (CNN, 2018). Potential explanations for this discrepancy is that the exit polls were wrong, or perhaps more states are allowing for early voting, forcing voters to have already made up their minds before the last 10 days of the election. Of course, another possible explanation is simply that more people in 2018 decided earlier than normal for whom to vote.

[3] There were generally a relatively low number of undecided voters which may have been a result of the question design which included the party affiliation of the candidates.

Another potential reason for the lack of undecided voters was the wording of the ballot test question. By including the party affiliation of the candidates, this could have helped cue voters on their preference, as voters may not know some of the candidates' names, but might vote based on party preference.

Data also was collected via IVR and Online, leaving out a potential interviewer bias error which may have led to interviewees being more willing to divulge their opinion. Such reasoning is based on the logic that those interviewed knew they were not actually speaking with a stranger, since voters might find their vote a personal choice, and are not apt to divulge it in a face to face, or in a telephone survey leading to indecision in their answer (Bradburn et al, 1978).

Yet, within this context, our analysis reveals there were very small differences in how the allocation of undecided voters in pre-election polls impacted the results, compared with all three metrics. The absolute error found virtually no difference in any of the poll categories (US House, US Senate, and Governor). In the statistical accuracy test, both metrics scored a passing mark, with 93% SA without leaners, and 94% with leaners. In predictive accuracy, 93% of polls without leaners projected the winning candidates and 91% of polls with leaners projected the winners.

Overall all three methods performed equally as well with no significant difference found in any of the research questions, also all of the allocation methods performed better than historical trends. Also important to note, is that there is no evidence gathered from this study regarding the reliability and validity of allocating the undecided voter that would refute Mitofsky's assertion that "*leaving the undecided in the base of the percentages reported does not serve the public's expectation or the pollsters' claims about accuracy"* (Mitofsky,1998).

In conclusion, there are many variables that can influence the accuracy of a pre-election poll, from sample design and selection, to the mode of data collection, to voter model projections and weighting of the data. This study examined question typology in the head to head ballot test question and found potential universal methods for working with undecided voters.

The authors recommend that future research be conducted in a similar study in other countries that have a different party structure than the current two party systems in the U.S. to examine if perhaps one way of improving pre-election polls is to include the party affiliation of the candidate in the polls, and to test the theory that voters are loyal to the party and not the candidate and by including party affiliation of the candidate, an unintended finding of this research is that it appeared to produce a lower undecided rate than what was expected in this study.

As democratic elections continue to be held around the world, the influence of pre-election polls on the public's expectations could impact the interpretation of the election results. When these pre-election polls forecast the wrong winners there is potential to de-legitimize the results of the election for some voters and create the opportunity for

the others to question the validity of the vote. For this reason alone the better survey methodology can be in projecting pre-election polls to actual results the more confidence voters will have in their voting system and this research tries in a small way to add to the knowledge of this important area of study.

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Appendix

Between-Subjects Factors

		Value Label	N
Case	1	No Allocation	54
	2	Proportional	54
	3	Leaners	53

Descriptive Statistics

Dependent Variable: Deviation

Case	Mean	Std. Deviation	N
No Allocation	3.88	4.068	54
Proportional	3.69	3.732	54
Leaners	3.93	4.026	53
Total	3.83	3.921	161

Tests of Between-Subjects Effects

Dependent Variable: Deviation

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1.735[a]	2	0.868	0.056	0.946	0.001
Intercept	2362.486	1	2362.486	151.854	0.000	0.490
case	1.735	2	0.868	0.056	0.946	0.001
Error	2458.108	158	15.558			
Total	4821.766	161				
Corrected Total	2459.843	160				

a. R Squared = .001 (Adjusted R Squared = -.012)

Descriptive Statistics

Dependent Variable: Deviation

Case	Mean	Std. Deviation	N
No Allocation	5.55	5.330	23
Proportional	5.22	4.991	23
Leaners	5.59	5.314	23
Total	5.45	5.139	69

Tests of Between-Subjects Effects

Dependent Variable: Deviation

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1.935[a]	2	0.967	0.036	0.965	0.001
Intercept	2051.544	1	2051.544	75.468	0.000	0.533
case	1.935	2	0.967	0.036	0.965	0.001
Error	1794.171	66	27.184			
Total	3847.650	69				
Corrected Total	1796.106	68				

a. R Squared = .001 (Adjusted R Squared = -.029)

Between-Subjects Factors

		Value Label	N
Case	1	No Allocation	17
	2	Proportional	17
	3	Leaners	16

Descriptive Statistics

Dependent Variable: Deviation

Case	Mean	Std. Deviation	N
No Allocation	2.56	2.197	17
Proportional	2.67	1.979	17
Leaners	2.53	2.181	16
Total	2.59	2.077	50

Tests of Between-Subjects Effects

Dependent Variable: Deviation

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	.173[a]	2	0.087	0.019	0.981	0.001
Intercept	334.849	1	334.849	74.518	0.000	0.613
case	0.173	2	0.087	0.019	0.981	0.001
Error	211.197	47	4.494			
Total	546.775	50				
Corrected Total	211.370	49				

a. R Squared = .001 (Adjusted R Squared = -.042)

Between-Subjects Factors

		Value Label	N
Case	1	No Allocation	14
	2	Proportional	14
	3	Leaners	14

Descriptive Statistics

Dependent Variable: Deviation

Case	Mean	Std. Deviation	N
No Allocation	2.73	2.201	14
Proportional	2.41	1.593	14
Leaners	2.79	1.693	14
Total	2.64	1.811	42

Tests of Between-Subjects Effects

Dependent Variable: Deviation

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1.171[a]	2	0.585	0.171	0.843	0.009
Intercept	292.934	1	292.934	85.746	0.000	0.687
case	1.171	2	0.585	0.171	0.843	0.009
Error	133.236	39	3.416			
Total	427.341	42				
Corrected Total	134.407	41				

a. R Squared = .009 (Adjusted R Squared = -.042)

Case * SA Crosstabulation

			SA		
			SA	NSA	Total
Case	No Allocation	Count	50	4	54
		% within Case	92.6%	7.4%	100.0%
	Proportional Allocation	Count	51	3	54
		% within Case	94.4%	5.6%	100.0%
	Leaners	Count	50	3	53
		% within Case	94.3%	5.7%	100.0%
Total		Count	151	10	161
		% within Case	93.8%	6.2%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.200[a]	2	.905
Likelihood Ratio	.195	2	.907
Linear-by-Linear Association	.140	1	.708
N of Valid Cases	161		

a. 3 cells (50.0%) have expected count less than 5. The minimum expected count is 3.29.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.035	.905
	Cramer's V	.035	.905
N of Valid Cases		161	

Case * PA Crosstabulation

			PA		
			PA	NPA	Total
Case	No Allocation	Count	50	4	54
		% within Case	92.6%	7.4%	100.0%
	Proportional Allocation	Count	50	4	54
		% within Case	92.6%	7.4%	100.0%
	Leaners	Count	48	5	53
		% within Case	90.6%	9.4%	100.0%
Total		Count	148	13	161
		% within Case	91.9%	8.1%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.197[a]	2	.906
Likelihood Ratio	.192	2	.908
Linear-by-Linear Association	.146	1	.702
N of Valid Cases	161		

a. 3 cells (50.0%) have expected count less than 5. The minimum expected count is 4.28.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.035	.906
	Cramer's V	.035	.906
N of Valid Cases		161	

Binomial Test – No Allocation

		Category	N	Observed Prop.	Test Prop.	Exact Sig. (1-tailed)
SA	Group 1	SA	50	0.93	0.95	.284[a]
	Group 2	NSA	4	0.07		
	Total		54	1.00		

a. Alternative hypothesis states that the proportion of cases in the first group < .95.

Binomial Test – Proportional Allocation

		Category	N	Observed Prop.	Test Prop.	Exact Sig. (1-tailed)
SA	Group 1	SA	51	0.94	0.95	.511[a]
	Group 2	NSA	3	0.06		
	Total		54	1.00		

a. Alternative hypothesis states that the proportion of cases in the first group < .95.

Binomial Test – Leaners

		Category	N	Observed Prop.	Test Prop.	Exact Sig. (1-tailed)
SA	Group 1	SA	50	0.94	0.95	.498[a]
	Group 2	NSA	3	0.06		
	Total		53	1.00		

a. Alternative hypothesis states that the proportion of cases in the first group < .95.