Sampling Methods for the NZCER Primary National Survey

Presented at NZARE Conference

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26-28 November 2013, Dunedin

Ref 110

NZCER conducts a Primary National Survey in a triennial cycle. This survey has a long history of giving a voice to primary and intermediate school principals, teachers, trustees and parents. Sampling methodology is used to draw a random sample of schools for the survey. Using the recent 2013 Primary National Survey as an example, this paper gives details and some discussion around the methodology used.

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Introduction

The first Primary National Survey was carried out in 1989 by the New Zealand Council for Educational Research (NZCER), the start of a regular series of surveys which settled into a triennial cycle from 1996[1]. The main focus of the initial surveys was the impact of the Tomorrow Schools reforms, initially funded by NZCER and now funded through NZCER's purchase agreement with the Ministry of Education. Over the years, the Primary National Survey has given a voice to school principals, teachers, trustees, and children's parents, on a variety of issues and policy changes, and their various impacts. The long history of the survey has allowed existing themes and issues to be tracked over time, as well as identifying new and emerging ones. The surveys are used by policy makers and researchers, and thus have some importance in the education sector.

The NZCER Primary National Survey is undertaken with a sample of schools. The use of statistical methodology in determining the sample of schools, and the sub-samples of the four different population that are surveyed, gives credibility to the robustness of the results. It is important to acknowledge that the methodology must be sound in order for the responses to have external validity. That is, the responses gathered from the survey will have relevance not only to the particular respondents in each round of surveying, but will be generalisable to a New Zealand population of intermediate and primary schools. Since the conception of the Primary National Survey Series, NZCER has used a random sampling methodology to create the sample.

This paper will detail the methodology used for the NZCER Primary National Survey, highlighting important details with the current 2013 survey. Some discussion of the strengths and weaknesses of the methods used will be given, as well as potential improvements for future Primary National Surveys.

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[1] A survey of secondary schools by NZCER was added to the series in 1996.

Sampling methods

Why we take a sample survey approach

The Primary National Survey aims to gather data that reflect the experiences of parents, teachers, principals and board members in New Zealand, and what they think about a range of issues. If the entire population of principals, teachers, trustees and parents in New Zealand were surveyed, this would be a census, and the views of each of these groups would be exactly represented. This is obviously impractical, and so a sample of these groups is drawn. If a sample is large enough, and drawn in the correct way, it does not matter that not everyone has been approached to answer the survey; the sample, with a certain degree of error, would be able to be generalised to the New Zealand population of primary and intermediate principals, teachers, trustees and parents.

Sampling method

Four surveys are conducted for each round of the Primary National Survey; a principal, teacher, trustee and parent survey. Each of these populations is accessed through schools. Therefore, the first step in the sampling process is to determine which schools are to be included. Traditionally, this has been a sample of around 350 schools. Prior to sample selection, the sample frame must be determined.

Sample frame

The sample frame is the set of schools from which the sample will be drawn. The aim of a sample frame is to create a list that enables us to target as many respondents as possible that we want in the survey, and exclude as many as possible that we don't. Each year the Ministry of Education releases a list of school information; this includes roll count data, some student demographic information, and other relevant school information. This is for all state, state-integrated, and private schools in New Zealand. The sample frame is determined from this list; for the 2013 survey, the data used was the Ministry's 2012 roll data (the most recent at the time).

Having a complete list of all schools in New Zealand is an advantage, but one downside to using this information is that it was put together the previous year and therefore out of date. For example, several schools around New Zealand had closed at the end of 2012, but this information was not reflected in the Ministry's available data. In reality, a sampling frame often misses some of the target respondents, and includes some that were not intended as targets. This is especially pertinent as a sampling frame for the Primary Survey is being created around schools, not individual respondents. For example, the parent survey is aimed at parents of school-aged children

in years 1-8, however with the exclusion of composite schools, not all parents of years 1-8 children will have the opportunity to fill in the parent survey.

For the purposes of defining a sample frame for this study, relevant classifications of New Zealand schools are type, definition, and authority. Forming our sample frame involves specifying the values of these classifications for which a school will be included or excluded. Table 1 shows the variable classifications used to define the sample frame, and the characteristics of schools that were excluded from the sample frame for the 2013 survey.

Table 1   **Sample frame characteristics: the defined target and excluded school populations.**

Classification	Defined target population	Excluded population
Type	Full and contributing primary, intermediate	Composite, restricted composite, secondary schools (7-10, 7-15)
Authority	State, state-integrated	Private
Definition	Not applicable, Model school, normal school (model classes), school with side school, school with boarding facilities	Designated character school, Kura Kaupapa Māori, special schools (e.g. school for physical disabilities), regional health school, bilingual school
School gender	Co-educational[2]	NĀ
Other		Any Christchurch school in the defined target population with a pending decision on closure or a merger.

Drawing the sample - stage one

In the first stage of sampling, 350 schools from the defined sample frame are selected to take part in the survey. These schools are selected using a stratified sampling method. Stratification involves defining groups based on certain characteristics, in this case school decile and school size, and then taking independent samples within each group. This method can have the result of improving the precision of estimates made from data collected. For the Primary Survey, this is done largely because there is a belief, and some evidence, that responses from schools can differ by size and decile characteristics (Wylie, Brewerton, and Hodgen, 2011). Deciles, which are a number from 1 to 10 roughly indicating the socio-economic characteristics of the families in the school zone, are grouped into low (1 and 2), medium (3 to 8), and high (9 and 10). These are the cut-offs for which there are generally differences found between schools as a result of school decile (Hodgen, Ferral, and Dingle, 2006). The number of students in a school, by school roll, is used to determine size. Schools with 100 or less students are defined as small, 101 to 200 students as small-medium, 201 to 350 students as medium large, and with 351 or more students as large.

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[2] After inclusion of specified type, authority, and definition, the remaining schools in the sample frame were co-educational with the exception of one girls' school.

With three decile bands and four size groupings, the sample frame is divided up into twelve mutually exclusive groups, from each of which an independent sample will be drawn. These groups are called stratum, and the process of sampling from them is called stratified sampling. Table 2 displays the number of schools defined by each stratum, for all schools in the sampling frame.

Table 2 **Strata for schools in sample frame.**

	Size n(%)				
Decile n(%)	Small	Small-medium	Medium-large	Large	**Total**
Low	96 (5)	100 (5)	74 (4)	60 (3)	**330 (18)**
Mid	401 (22)	249 (13)	260 (14)	217 (12)	**1127 (61)**
High	87 (5)	82 (4)	96 (5)	138 (7)	**403 (22)**
Total	**584 (31)**	**431 (23)**	**430 (23)**	**415 (22)**	**1860 (100)**

The number of schools to be sampled from each stratum is proportional to the number of schools in each stratum of the sample frame, given the total number of schools desired for the entire sample. In table 2 showing the sampling frame, there are 415 large schools. Table 3 shows the calculations for determining the number of schools sampled from each decile band, for large schools. The number of schools to be drawn from each stratum is determined in the same way. The full sample distribution for 2013 is shown in table 4; the percent of the total for each strata is the same as in the sample frame (table 2).

Table 3 **Calculations for stratum allocation, for large schools.**

Decile	**Percent in sample Frame[3]**	**Calculation**	**Number to be sampled**
Low	3.20	0.032*350 = 11.2	11
Mid	11.57	0.1157*350 = 40.5	41
High	7.36	0.0736*350 = 25.8	26
Total	22.13	-	78

Within each stratum, each school has given equal probability of being sampled, and the numbers shown in table 4 are drawn independently from each stratum by simple random sampling. It is important to note that every school has the same probability of selection. That is, in each stratum, each school has the same probability of being selected as each school in every other stratum. For example, there are 60 low-decile large schools in the sample frame, and from the calculation in table 3, 11 schools were sampled. Therefore the sampling fraction is $11/60 = 0.183$. Similarly,

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[3] Values rounded to two decimal places are used here, whereas completely rounded values are shown in table 2.

for mid-decile large schools, the sampling fraction is $41/217 = 0.188$[4]. The same calculation can be shown for each stratum, and simply illustrates that each school has the exact same chance of selection.

Table 4 **Strata for schools in the 2013 sample**

	Size n(%)				
Decile n(%)	Small	Small-medium	Medium-large	Large	**Total**
Low	19 (5)	19 (5)	14 (4)	11 (3)	**63 (18)**
Mid	76 (22)	46 (13)	49 (14)	41 (12)	**212 (60)**
High	17 (5)	15 (4)	18 (5)	26 (7)	**76 (22)**
Total	**112 (32)**	**80 (22)**	**81 (23)**	**78 (22)**	**351 (100)**

Drawing the sample - stage two

With the sample of schools determined, the samples for each of the four populations to be surveyed need to be defined. For the principal sample, as there is one principal per school, this is determined by the sample of schools. For the trustees sample, two trustee members are to be surveyed from each school. The instructions are to give the second survey to someone whose views may differ from their own. The teacher and parent samples involve some extra work.

Teacher

The number of teachers in each school is not readily available, easily accessible information. Thus, the number of teachers at each school is estimated by the number of pupils, using information from the Ministry on year level teacher to student ratios.

Table 5 **Table showing student teacher ratios.**

Year of schooling	Non-Māori immersion teacher: student ratio
Year 1	1:15
Year 2-3	1:23
Year 4-8	1:29

The average of the three ratios given for primary and intermediate-aged school children is a little over 1:22, thus this was the ratio assumed for the purposes of determining a teacher sample. There are several problems with this. First of all, averaging the three ratios when each ratio is for a different number of year levels gives a biased result. Secondly, schools with three different year level combinations are being considered. Thirdly, schools with fewer than 176 students have curriculum staffing of at least one teacher to ever 25 students (these are the small, and some of the

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[4] The small differences in sampling fractions calculated here are due to previous rounding.

small-medium schools in the sample). However, with no alternative, this is not an unreasonable method of estimating teacher numbers.

Using the average ratio of Ministry staffing entitlement, the number of teachers per school can be estimated from the Ministry's roll data. The total number of students per school is divided by 22 to approximate the number of teachers at each school. What follows is a systematic sample of teachers. However, this final stage of sampling is left in the hands of each school's principal. Instructions are to, working from a list of all teachers' names, select 1 in every 2 teachers after randomly selecting the first. If done correctly, this process constitutes a systematic random sample. As the same proportion is selected from each school, the selection probabilities for teachers at all selected schools are still approximately the same (assuming accurate estimates).

Parent

The parent survey is not administered to parents from every school. Instead, a subset of 10% is selected from the 351 schools in the sample. This is again done to ensure that there is a reflection of the decile and size characteristics seen in the sample frame. The schools chosen are contacted to advise them that they have been selected as a parent school in the Primary National Survey, and to request their participation as a parent school. Cooperation from each school is ascertained in advance because the school principal is required to distribute the surveys. If they decline, they are retained in the sample for the principal, teacher, and trustee surveys, but replaced as a parent school with another school from the 351 schools selected. This is continued until there are 36 schools agreeing to participate in the parent survey; fifteen schools declined to take part, therefore a total of 51 schools were contacted to finalise the parent sample. This selection method leaves the sample open to self-selection bias. For example, say that the schools that decline might be schools that know they have an unhappy parent community. In other words, there may be something different about the parent communities in the schools that decline, compared to the schools that do not participate - especially as the decision to be involved comes from the school and not the parent community. As with the teacher sample, each parent should have a similar chance of selection to all other parents in the selected parents schools.

Difficulties associated with surveying schools

Surveying schools presents some difficulties. In the case of the Primary National Survey, four different groups of people are being contacted. The easiest way to do this, given the populations

being targeted, is through the schools as a *cluster*. This presents an array of practical and statistical issues that must be taken into consideration.

Practical considerations

Necessary information: The ministry's roll data is used to estimate parent and teacher survey numbers. For 2013, preliminary roll data is released in July, but not finalised until October. The sample is finalised in July and it is necessary to use the previous year's roll data. However, school profile information is released at the beginning of the year, and this was used to cross-reference school numbers against the previous year's roll data to identify schools that had closed.

Timing: Timing the survey correctly to fit into the school year is important. The beginning and end of the school year are avoided as they are generally particularly busy times of the year, as are the beginning and end of school terms. Term breaks would be a poor timing choice for obvious reasons. This leaves a small window in term two or term three where the surveys can be administered.

Contacting respondents: Parents and teachers have to be contacted through the school principal. There is no complete registry of primary school teachers, and finding parents of primary-aged children in the general population would be rather difficult. If there needs to be follow-up, or contact, this has to go through the principal for parents and teachers.

The biggest difficulty with accessing the parent and teacher populations is the reliance on principals to conduct the final stage of sampling. Prior to the survey taking place, schools are contacted to establish involvement in the parent survey (which does guarantee cooperation from that school). Furthermore Clear instructions are sent to principals, but there is no guarantee that these are followed.

Sufficient parent numbers: As feedback is offered to the school for their parent respondents, the parent sample needs to be large enough so that individual parent responses cannot be identified; this is an ethical consideration, and a potential problem for very small schools. In addition, for the survey responses to have validity for any one school, the number of respondents cannot be too small. For the 2013 survey, the sampling fraction was increased from 1/7 to 1/4.

Response rates: Once the sample is drawn, it is imperative that as many people as possible respond, therefore convincing people to take part is essential. Several techniques are employed to mitigate non-response. All surveys are sent with an information sheet detailing the reasons for conducting the survey, in the hope of increasing parental awareness about the value of the survey and encouraging parents to have their say. NZCER guarantees confidentiality for all respondents; data is not stored with any identifying information, and only collated data is reported. All respondents have the chance to go in the draw to win book tokens or petrol vouchers. All parent respondents are offered feedback on their school's collated parent responses, and schools are sent the same feedback; this is an attempt to engage the parent population in the survey process, and

offer the schools involved some potentially very valuable information. A reminder is sent to the principal two weeks after receiving the surveys, to encourage responses. Survey length is important, as people can be less likely to respond if the survey is too time consuming.

Methodology issues

Most of the considerations detailed above are a compromise between practicality or cost, and methodology. These compromises often favour the former over the latter.

The current sampling methodology for the Primary National Survey relies heavily on principals' cooperation. They are required to complete the final stage of sampling and survey distribution for teachers and parents, and are also relied on for any follow-up in terms of getting surveys back. It has to be assumed that this is not always carried out correctly, leaving room for the idea that there is some selection bias in which parents and teachers are taking part.

In addition to the potential selection bias for parents, calling schools to request parent involvement potentially creates bias in which schools are even a part of the parent sample. The process of requesting involvement leads to a situation not unlike what is known as quota sampling; schools continue to be approached until the required number of schools for each stratum is established. Although additional schools are selected randomly, at this point the parent sample ceases to be a random sample.

The parent and teacher samples in the Primary National Survey are not independent samples of parents or teachers. They are associated with each other through the school teachers teach at, or the school their children attend. Each school sampled is essentially a 'cluster' of respondents with respect to both the teacher and parent samples. Teachers surveyed from the same school can be expected to be more similar in some aspects than teachers surveyed from different schools. The same is true of the parent sample. In terms of the entire parent and teacher samples, sampling larger numbers of either of these populations from any one school decreases the overall efficiency of the sample. To calculate this decrease in efficiency, information about how similar the teacher or parent responses at the same school are, compared to responses between different schools would be necessary. This would vary depending on the question being asked, and would be impossible to determine for the more qualitative parts of the survey. This is relevant because, as a proportion of teachers and parents is sampled from each school, the numbers of each population sampled at each school vary depending on the school size - the larger the school, the more parents and teachers selected to be surveyed.

For the parent survey, the absolute number of parents sampled from each school is pertinent because of the feedback offered. First, there need to be enough respondents to guarantee anonymity. Second, for the feedback to be useful to the school, the number of respondents needs to be large enough to have some internal validity. The sample fraction for parents at each school was adjusted for the 2013 survey, to allow for large enough numbers for school feedback on the parent survey. Still, eight parent schools of the 36 sampled were sent 10 or fewer parent surveys.

Out of the returns, 15 schools returned ten or fewer parent surveys. As the sample is essentially non-random and not necessarily generalisable, a future consideration is that it would perhaps be more useful to sample a set number of parents from each school to ensure appropriate numbers of respondents.

As with the parent survey, the teacher survey could benefit from being sampled differently. If each school was defined as a population of teachers, then sampled with probability proportional to the number of teachers at that school, the same number of teachers could be sampled from each school. This would potentially have the effect of lessening the inefficiency of a sample caused by sampling in clusters. However, there are obvious drawbacks. There are schools that may be too small and would have to be excluded, or combined with a school of similar characteristics and treated as one for the purpose of sampling and feedback. Mainly, it would mean that the teacher sample would have to be drawn independently from the others; this is not done because it is much more practical and cost efficient to be approaching the same set of schools for all surveys.

The teacher sample in the Primary National Survey is defined in terms of the schools that teachers are sampled from. Currently, there is no information as to whether this sample is actually a representative sample of teachers. That is, in terms of individual characteristics, as well as some school characteristics, do the characteristics of the Primary National Survey sample of teachers reflect the national population of primary and intermediate school teachers. This information in its entirety is difficult to come by; collated information is available on the Ministry of Education's 'Education Counts' website and is not particularly useful for this purpose.

Summary

Although the parent surveys are not necessarily generalisable, they still provide a wealth of information and are an important insight into the parent community. Furthermore, the parent surveys provide invaluable feedback to schools.

The teacher surveys, are teacher opinions and ideas from a representative sample of schools. More work could be done in determining whether this sample is representative of the national primary and intermediate school teacher population.

Contacting all four sample populations through the same set of schools is convenient, but creates some problems with the sample, particularly with respect to the teacher sample.

Overall, the Primary National Survey is an invaluable tool, gathering ideas, opinions, and feedback from parents, teachers, principals, and trustees. It is, however, important to acknowledge the limitations present. There are potential improvements to be made, however these vie with

necessary practical considerations. An understanding of the methodology behind the surveys, as well as an acknowledgement of potential limitations, is important to bear in mind as the Primary National Survey is being analysed and interpreted.

As NZCER prepares for the next iteration of the Primary National Survey in 2016, the methodology from previous surveys will be reviewed. Where possible, improvement to the current methodology will be implemented.

References

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