

Teachers' intentions to use national mathematics assessment data

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Introduction

The educational policy environment has, in recent years, seen an increased emphasis on data-driven change. This has increased the expectation for school personnel to use statistical information to inform policy and to improve teaching practices. Such data include system reports of student achievement tests and socio-economic profiles provided to schools by various state education departments' data services. This paper reports on a pilot study that explored factors affecting mathematics teachers' intentions to engage with the statistical data their school receives and to consider this data when making decisions about their teaching practice.

Background

There is an abundance of data being generated about students and schools, and supplied to principals, teachers, and parents. The supply of data seems to be built on an assumption that those who receive such reports have the capacity—in terms of knowledge about statistical measures, terms and representations—to interpret them effectively. There is some evidence that the reality may be different. Loudy and Wildy (2001), in their early report on the work of the Western Australian Data Club (DETWA, 2006), note that the key reason principals were not making use of the Western Australian Literacy and Numeracy Assessment data was “because they did not know exactly what the data meant” (p. 7). Principals also commented on the need for teachers to gain the skills and understanding necessary to extract pertinent information from such data.

There are, however, additional factors that may affect the extent of teachers' and principals' data use. Whereas lack of knowledge and understanding can clearly have a limiting influence, attitudes, beliefs, and perceptions also impact on the degree to which teachers engage with statistical information provided. Negativity towards statistics is well entrenched in the community. Wallman (1993) noted a common series of ‘mis-es’ in relation to statistics: misunderstanding, misperception, mistrust and misgivings. The Statistical Society of Australia, 2005, pointed out that statistics has a poor image and profile in Australia among students, parents, and the general public. Negativity towards statistical information and lack of confidence in analyzing statistical data may discourage education personnel from other than cursory engagement with such information. Previous research (e.g., Gal, Ginsberg, & Schau, 1997; Pierce, 1989, 1995) has shown that mathematics anxiety, for example, can inhibit both the learning and use of statistics. Any study of statistical literacy for the workplace must go beyond consideration of knowledge and skills to identify such barriers. Engagement with quantitative system data and adoption of its use as a basis for decision-making and planning is unlikely to occur unless teachers both perceive the use of statistics to be valuable and are confident that they have the necessary skills to use them.

Adopting new practices—in this case using quantitative data as a basis for decision-making—involves a change in behaviour for teachers. The Theory of Planned Behaviour (TPB) (Aizen, 1991) tells us that people are unlikely to change unless they

have a strong intention to change. Francis *et al.* (2004, p.7), elaborating on TPB, explain that predicting whether a person intends to do something, requires knowledge of

- Whether the person is in favour of doing it (*attitude*) [e.g., “I can see the benefits of data-driven decision-making so I want to learn more about it”]
- How much the person feels social pressure to do it (*subjective norm*) [e.g., “No one else is bothering to use these data, so why should I?”]
- Whether the person feels in control of the action in question (*perceived behavioural control*) [e.g., “I don’t know enough stats, so I can’t use the data for decision-making”]

If the “score” on these three predictors can be improved, it should increase the chance that the person will intend to perform the desired action and thus increase the likelihood of the person actually doing it. In studies across the health, social, and behavioural sciences (see, for example, Armitage & Conner, 2001) TPB has consistently shown that attitudes, subjective norms, and perceived behavioural controls are strongly predictive of behavioural intent. The issues associated with behaviour change for Principals and teachers can be seen to parallel those explored in other TPB studies related to, for example, use of technology (Pierce & Ball, 2009). The present pilot study employs the framework of TPB to identify principals’ and teachers’ negative perceptions (barriers) and positive perceptions (enablers) of both engaging with quantitative data and adopting data-driven decision-making. While other frameworks—e.g., the model developed by Prochaska and DiClemente (1983)—guide the description of stages of behaviour change, TPB provides a framework for this study to focus on the affective factors that enable or form barriers to teachers’ intention to change.

This Pilot study – secondary mathematics teachers

Forty-nine secondary school mathematics teachers from 16 schools attending a mathematics teachers’ professional development program volunteered to complete a pilot survey and gave permission for their data to be used for research purposes. (Ethics approval for such data collection had previously been granted by the Melbourne Graduate School of Education’s Human Research Ethics Committee.)

The survey consisted of nine background items on the use of national assessment data in their school, as shown below in Table 1. This background section probed the schools’ and teachers’ access to and use of Achievement Improvement Monitor (AIM) data or National Assessment Program - Literacy and Numeracy (NAPLAN) data. Both sets of data were referred to since both data sets were part of a national testing program for literacy and numeracy. The change to the Victorian State AIM tests to the National NAPLAN tests had taken place in the previous year so while the data reports were similar teachers had only had experience of one set of NAPLAN reports. These data were linked, anonymously, to the teachers’ demographic details, supplied on an earlier unrelated survey.

Following the background items there were 30 Likert-scale items consisting of statements to which the teachers were asked to indicate their level of agreement on a 5-point scale from Strongly Disagree to Strongly Agree. In line with TPB, items targeted attitudes (13 items, see Table 2), subjective norms (4 items, see Table 3) and perceived behavioural controls (13 items, see Table 4). For simplicity AIM and NAPLAN reports and data were just referred to as NAPLAN reports or data in these

survey items. This convention will be followed throughout this paper. In the survey, as presented to the teachers, the three different categories of items were interspersed, but for the purpose of presenting the results they have been grouped by category into Tables 2, 3 and 4 and renumbered. The results from the survey are presented and discussed below.

Table 1

Survey items targeting school background and teachers use of AIM/NAPLAN data

<p>In your school :</p> <ol style="list-style-type: none">1. Who has direct access to the AIM / NAPLAN data?2. What use is made of the AIM / NAPLAN data at the school level?3. Does your school provide you with any information / reports based on system data such as AIM / NAPLAN? If YES, please give details.4. Do you have access to the results for the students in your classes? If NO, skip to question 8. If YES, please continue to question 5.5. Do you choose to access the data? If NO, skip to question 7. If YES, please continue to question 6.6. Yes – What sort of reports do you use and what do you look for?7. No – Why not?8. Have you ever made a change to your teaching plans as a consequence of some analysis of your school’s AIM / NAPLAN data? If YES, please give brief details.
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Results and discussion

In Tables 2, 3, and 4 percentages are rounded to the nearest whole percentage point; due to this rounding the percentages may not total to 100%. Percentage values are based on valid responses from the 49 participants; there was only one question that was missing 5 responses, whereas the rest were missing 0 or 1, and occasionally 2 or 3.

The results presented in Table 1 indicate that in general these mathematics teachers held positive attitudes towards NAPLAN data. The strongest positive responses were to items A4, A8, and A10, with around 85% of the teachers responding positively to “NAPLAN data is useful for identifying topics of the curriculum that need attention in our school”, “I think that it is important that I have access to the NAPLAN data from my own students”, and “I want to make more use of the NAPLAN data than I do now”. A similar number felt that “NAPLAN data is useful for identifying weak students” (item A3).

Despite this positive response it is important to note that there was a small group of these teachers who responded negatively about aspects of the NAPLAN data. Only 39% of the teachers disagreed with the statement “NAPLAN data doesn’t tell me anything that I don’t already know about my students (this item, A12, is reverse coded in Table 2), with 28% agreeing with it and the rest were neutral. The teachers were ambivalent about NAPLAN’s capacity to identify misconceptions, with only 41% agreeing that it is useful for this purpose, and 28% disagreeing (item A5).

Table 2
Percentage response to survey items targeting attitude (n=49)

	SD	D	N	A	SA
A1. NAPLAN data is helpful for grouping students.	0	6	40	54	0
A2. NAPLAN data is helpful for planning instruction.	2	8	31	52	6
A3. NAPLAN data is useful for identifying weak students.	0	6	10	71	13
A4. NAPLAN data is useful for identifying topics of the curriculum that need attention in our school.	2	2	10	67	19
A5. NAPLAN data is useful for identifying students' misconceptions.	4	24	30	37	4
A6. NAPLAN data reflects what my students understand.	2	9	38	51	0
A7. NAPLAN data is useful for identifying students' knowledge.	0	8	31	60	0
A8. I think that it is important that I have access to the NAPLAN data from my own students.	4	2	8	65	20
A9. I think our school should make more use of the NAPLAN data than it does.	2	6	20	41	31
A10. I want to make more use of the NAPLAN data than I do now.	2	4	8	57	29
<i>A11. NAPLAN data is not directly relevant to my teaching. *</i>	2	4	25	60	8
<i>A12. NAPLAN data doesn't tell me anything that I don't already know about my students. *</i>	4	23	33	33	6
<i>A13. NAPLAN data doesn't reflect my students' capabilities. *</i>	0	6	46	44	4

SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree, SA = Strongly Agree

* Items marked with an asterisk and in italics are couched negatively. In this case the scores have been reverse coded; this means that positive views are easily scanned from the table, but that the question must then be interpreted in the opposite direction.

As mentioned, teachers expressed a desire to use NAPLAN data (item A10). This attitude did not appear to be prompted by what they perceive as the behavioural norms for their school, as seen in Table 3. Only 16% of these teachers felt that their school expected them to engage closely with the NAPLAN data for the students they were teaching (item SN1), and 33% felt that other teachers that they respect take little notice of the data (item SN4).

Table 3
Percentage response to survey items targeting subjective norms (n=49)

	SD	D	N	A	SA
SN1. The leadership team at my school expect me to closely analyse my students' NAPLAN results.	27	39	18	14	2
SN2. Most of my students' parents expect that I am familiar with their child's NAPLAN result.	17	27	29	27	0
SN3. Most of my students' parents expect that I have a working knowledge of our schools' NAPLAN results	19	26	30	26	0
<i>SN4. Other teachers whom I respect take little notice of our school's NAPLAN data.*</i>	4	29	42	23	2

SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree, SA = Strongly Agree

* The item marked with an asterisk and in italics is couched negatively. In this case the scores have been reverse coded; this means that positive views are easily scanned from the table, but that the question must then be interpreted in the opposite direction.

Table 4 presents the data about perceived behavioural controls. The majority of teachers perceived that lack of access, lack of time, and lack of guidance for interpreting reports were issues that affected their use of NAPLAN reports. Just over half of the teachers indicated that they do not get access to the data, and a similar number felt that it is not in a form that allows them to do the analysis they require (items BC2 and BC3). Only 24% suggested that they have enough time to study the NAPLAN data (item BC11), while 53% expressed a desire for guidance on how to interpret NAPLAN data (item BC10).

Most of these teachers were confident that they can understand the statistical analysis 61% (item BC7), but it is interesting that, given that this survey was administered to a group of secondary school mathematics teachers, the remaining 39% were not positive in their response to this item. Only 41% thought that NAPLAN reports are easy to understand (item BC1) and 37% were neutral. Responses to item BC12 (“I am not sure how to make sense of the NAPLAN reports”) were similar. These teachers’ perceptions of their colleagues suggest that the situation for non-mathematics teachers may be worse. Only 23% gave positive responses to item BC8 (“Most secondary teachers, not just mathematics teachers, are able to understand the NAPLAN reports”) and just 19% responded positively to item BC9 (“Most secondary teachers, not just mathematics teachers, are able to understand the statistical analysis of NAPLAN data”).

Table 4
Percentage response to survey items targeting perceived behavioural controls (n=49)

	SD	D	N	A	SA
BC1. NAPLAN reports are all easy to understand.	2	20	37	39	2
BC2. I have access to NAPLAN data in a form that allows me to get the results and analyses that I require.	19	33	13	29	6
BC3. I am given NAPLAN reports.	21	31	6	31	10
BC4. I can easily analyse the NAPLAN data.	6	25	33	31	4
BC5. The NAPLAN reports which parents receive are easy to understand.	2	9	55	32	2
BC6. The NAPLAN reports which teachers at our school see are easy to understand.	0	19	38	38	4
BC7. I am confident that I understand the statistical analysis of NAPLAN data.	0	13	26	52	9
BC8. Most secondary teachers, not just mathematics teachers, are able to understand the NAPLAN reports.	10	23	44	21	2
BC9. Most secondary teachers, not just mathematics teachers, are able to understand the statistical analysis of NAPLAN data.	13	33	35	19	0
BC10. I wish I had guidance on how to interpret NAPLAN data.	0	22	25	45	8
<i>BC11. I don't have enough time to study the NAPLAN data.*</i>	22	33	20	22	2
<i>BC12. I am not sure how to make sense of the NAPLAN reports.*</i>	2	19	33	35	10
<i>BC13. I am not sure how to use NAPLAN data to inform my teaching of a particular topic.*</i>	2	31	25	39	4

SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree, SA = Strongly Agree

* The item marked with an asterisk and in italics is couched negatively. In this case the scores have been reverse coded; this means that positive views are easily scanned from the table, but that the question must then be interpreted in the opposite direction.

The initial background items from the survey gave some indication of current practices and allowed teachers to comment about this. Questions 3, 4, 5 and 7 from Table 1 are examined here. Twelve of the teachers said that their school did not provide them with any information or reports, and only 29 of the teachers said that they actually had access to data for their classes. Of these 29 teachers, nine of them said they did not actually choose to access the data despite its availability. Among the teachers who said they did not choose to access the data were four comments on their lack of time, a claim that because NAPLAN was a “general test” he/she was not able to help students because he/she cannot see exactly what students did wrong, and an expressed belief that teachers will be told (presumably by more senior staff) about important implications and required actions arising from the results. Among the remaining 20 teacher who said they *did* access the data, there were comments about the ways in which data were used, with 18 saying that they used the data to determine students’ levels of understanding, weaknesses, and strengths. One teacher commented that difficulties in particular learning areas could be identified from the data. Finally, one of the teachers who currently does not have access to the data wrote that he/she would like access.

There were 43 teachers who responded to the question about whether or not they had made changes to teaching plans based on some analysis of their school’s AIM or NAPLAN data, with 65% saying that they had not. One teacher commented that he/she would like to, while two others explicitly stated that the data just reinforces what they already know about their students. There were four comments from the 35% of teachers who said they had made changes, mentioning that teachers had made modifications to programs for both stronger and weaker students, and focused on areas of identified weakness.

Implications and conclusions

The results from this pilot study indicate that teachers see potential for using the student assessment data arising from external testing such as AIM and NAPLAN. In particular, they saw its value for the identification of weak students and of curriculum topics that need attention. Despite this perception of usefulness, however, most of the group felt under no pressure to engage with the data; moreover, lack of access to the data was a key perceived behavioural control. Most teachers would like more guidance on how to make use of the data, with many expressing a concern that the reports are not easy to understand. These mathematics teachers further perceived that teachers without a mathematics background will have difficulty making sense of the NAPLAN reports.

This data set came from a relatively small group of mathematics teachers, and gives some insight into the affective issues that might influence teachers’ engagement with assessment data. To obtain a more accurate picture a larger and more diverse sample is required. Such an investigation should be supplemented by interviews to determine the strength of the barriers to engagement and how to overcome these. Furthermore, there is a need to investigate the statistical literacy needed to interpret and make use of these reports. These two factors—statistical competence and affect—together will govern the extent to which teachers and principals are able to interpret data and make consequential teaching and policy decisions that might lead to better outcomes for students. If intended users lack the necessary skills and do not believe in the value of the data, the potential benefits of such large-scale testing and reporting will not be realised.

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