

The desks have changed; it must be NAPLAN time: How NAPLAN affects teaching and learning of mathematics

Linda Cranley, Christine Robinson, Gregory Hine and Dee O'Connor

The University of Notre Dame, Australia

The National Assessment Program - Literacy and Numeracy (NAPLAN) was introduced into Australian schools in 2008. Since NAPLAN's standardised tests are now regarded as high-stakes assessment, how well students perform has now become much more important. The findings presented in this paper pertain to students' experiences of how NAPLAN has affected their learning of mathematics. This investigation makes a contribution to understanding student experiences of high-stakes testing, from an Australian perspective. To best ascertain students' experiences of NAPLAN and to gain an understanding of how NAPLAN affected the teaching and learning of mathematics, a qualitative approach to research design was selected.

Introduction

High-stakes standardised testing regimes to improve students' literacy and numeracy capabilities continue as common practice within Australian schools, despite international research suggesting that these tests cause negative consequences to students' well-being (Hardy, 2014; Swain & Pendergast, 2018). In Australia, the National Assessment Program - Literacy and Numeracy (NAPLAN) (ACARA [Australian Curriculum Assessment Reporting Authority], 2016) is a standardised test with considerable 'high-stakes'. NAPLAN occurs every year within Australian classrooms for students in Years 3, 5, 7 and 9 and assesses students' abilities in reading, writing, language conventions and numeracy. The NAPLAN assessment is administered under guidelines set by national protocols to ensure the integrity of the test. Schools are required to follow a code of conduct which outlines who should participate in the test, the test environment and test preparation strategies (NAP [National Assessment Program], 2016).

The results of NAPLAN are relied upon for entry into some secondary schools which increases the stakes of NAPLAN tests for students (McGaw et al., 2019) and are viewed as indicators of future school success (Attard, 2018; Cranley, 2018). In New South Wales, for example, parents nominating their child for selective school exams, are asked to provide permission to access their child's NAPLAN results (Wilson, Piccoli, Hargreaves, Ng & Sahlberg, 2021).

Individual NAPLAN results are provided to parents and schools and then school-based results are published online, contributing to the high-stakes nature of this assessment (Ragusa & Bousfield, 2017). With international research suggesting that pressure to perform well in such high-stakes testing results in increased student anxiety (Howell, 2017; Huberty, 2004), this paper presents findings on how the political agenda support of NAPLAN have altered the pedagogies teachers implement in the lead-up to NAPLAN, and how this has affected students' learning experiences. The findings presented in this

article emanated from a larger study that investigated how NAPLAN affected the specific teaching and learning of mathematics for students in a Western Australian primary school.

Background

Historically, NAPLAN was a response to Australia's declining performance in international testing results including those from the *Program of International Student Assessment* (PISA) and *Trends in International Mathematics and Science Study* (TIMSS) (Rudd & Smith, 2007). In the policy statement *The Australian Economy Needs an Education Revolution*, Rudd and Smith (2007) proposed that the Australian government increase its investment in education by introducing a mandatory standardised test known as NAPLAN. Arising through political motivation, NAPLAN was first introduced into Australian schools as a test based on national statements of learning for English and mathematics as there was no common curriculum in Australia. Since the implementation of the Australian Curriculum in 2017, NAPLAN has been aligned with the content in the numeracy and English curriculums (McGaw et al., 2020). Every student who participates in NAPLAN across Years 3, 5, 7 and 9 receives an Individual Student Report of their results. Since 2010, comparative NAPLAN results of all participating schools are published on the *My School* Website (McGaw et al.). NAPLAN was the first national standardised test to be implemented within primary and secondary education in Australia (ACARA, 2016) and is used as an accountability tool to compare state and territory results and within states as a comparison of individual school results (Swain, Pendergast & Cumming, 2018).

Literature review: Student anxiety and the impact of NAPLAN

Existing research has found that high-stakes testing has a negative impact on student anxiety levels (Howell, 2017; Huberty, 2004). Student anxiety is widely reported upon and acknowledged by the media (Ferguson, 2019) and stakeholders. Huberty explored the effect anxiety levels can have on the results students achieve; for instance, some students' increased anxiety can result in failing the test or not performing at their best even though they may know the material. Belcastro and Boon (2012) presented reasons for the need for the student voice to be heard in a high-stakes testing environment. These researchers argued that the understanding of students' perceptions and feelings for the test allows educators to incorporate effective strategies for students to improve the outcome and results of these tests. Dulfer et al. (2012) stated that the dramatic shift towards a focus on improving performance in NAPLAN was impacting upon the personal well-being and educational experience of students; such findings have been well-documented (Khanam, 2018; Mayes, 2018).

The extant literature specifically comments on the effect of high-stakes testing on young children. Studies identify a significant impact of formalised testing on both children and their educators (Bagnato & Yeh Ho, 2006; Paris & McEvoy, 2000; Roberts, Barblett & Robinson, 2019). In particular, formalised tests such as NAPLAN are usually completed in a test-environment of desks in rows, which is not typical of primary classrooms, and can cause apprehension and anxiety among young students (Roberts et al., 2019). Paris

and McEvoy highlighted the repercussions of standardised test conditions, which are unnatural in an early childhood setting. High-stakes testing procedures are generally decontextualised from the typical daily activities and routines of children in home, early childhood centres, classroom and community settings. According to Bagnato and Yeh Ho (2006), children do not display their competencies by sitting quietly at tables and responding on demand which is often a requirement of such tests. Paris and McEvoy (2002) reported that students can freeze, experience anxiety and suffer physical distress as a result of high-stakes testing. The evidence from a study conducted by Dulfer et al. (2012) concluded that students reported feeling physically sick, experiencing sleeplessness, and engaging in bouts of crying, as well as psychological responses such as an inability to cope and experiencing feelings of inadequacy.

Belcastro and Boon's (2012) study found that over 90 per cent of teachers interviewed stated that their students showed signs of feeling stressed. In Dulfer's study, 1200 teachers commented on student avoidance behaviours (e.g. absenteeism), physical health issues and negative emotions like fear, and confusion; all indicators of negative affect. Prior to the research by Dulfer et al. (2012), O'Keeffe (2011) discussed several effects NAPLAN testing had on student mental health and well-being, the resulting argument being that little effort was being made to identify how students feel about NAPLAN testing.

High-stakes testing also evokes anxiety in older students, despite these students having had more experience sitting a standardised test. Literature suggests that older students continue to experience anxiety as they understand the importance of achieving favourable results (Goodwin, 2012; Haladyna et al., 1998; Huberty, 2009). To illustrate, Huberty (2009) reported that up to 30% of students experience a condition termed 'test anxiety'. Due to this anxiety, students found it difficult to perform at their best, failing sections of standardised tests despite knowing the material. In turn, the diminished results of these tests could lead to low self-esteem and a loss of motivation (Huberty, 2009). Huberty further discussed the consequences for older students completing high-stakes tests, stating that they were likely to experience anxiety and their ability to do their best would be impaired.

Research on the inequities of high-stakes testing for lower-achieving students illustrates that these students are disadvantaged as they are required to sit a 'one-size fits all' test (Bagnato & Yeh Ho, 2006; Carter, 2012; Lingard, 2009; Mayes, 2018). Standardised tests are not designed to meet the specific needs of lower-achieving students. This 'one-size fits all' testing also results in students with additional needs not being able to display their true understanding of mathematical concepts which may lead to a lower self-esteem (Carter, 2012). Items in high-stakes tests can be discriminatory to children with additional needs (Bagnato & Yeh Ho, 2006). Specifically, test items that have fixed stimulus characteristics and require response modes cannot be exhibited by many children with sensory, motor, language and social behaviour limitations (Bagnato & Yeh Ho, 2006). In relation to NAPLAN, Carter (2012) conducted research into the effects of the time restraints placed on students sitting the NAPLAN assessment. Carter's research suggested that students may not have had sufficient time to show what they could do, an issue which can be even more problematic for special needs, and lower achieving students. The challenging nature

of NAPLAN was further explored by Davidson (2009), who posited that special needs and low-achieving students face major problems with NAPLAN as results indicate that high-stakes testing does not always bring out the students' best work.

Research findings indicate how standardised testing can increase student anxiety about the testing experience, diminish the enjoyment of learning and reduce the value of the testing. To illustrate, a number of scholars have affirmed that test anxiety is an enduring problem for between 25-30% of students sitting high-stakes tests (Grieve, 2012; Haladyna et al., 1998; Huberty, 2009). Most of this anxiety is related to pressure to perform well on the test (Huberty, 2004). High-stakes testing such as NAPLAN can be a threat to both the well-being of children and the quality of their education (Grieve, 2012). Further results in Grieve's study found that NAPLAN had the potential to lower self-esteem, self-image and long-term confidence of underperforming students, thus widening the gap between them and their higher-achieving peers. Prior to this claim, Goodwin (2012) supported the negative effects high-stakes testing can have upon a student's wellbeing and self-esteem, stating that focusing on the results of testing may significantly decrease the motivation and self-esteem of children, and lead to premature labelling of children. This lowered self-esteem can then lead to poor achievement in tests which, in turn, can result in children not being provided with targeted learning opportunities for remediation or extension (Goodwin; Grieve & Lingard, 2009). Such misrepresentation of children through mismeasurement denies them their rights to beneficial expectations and opportunities (Neisworth & Bagnato, 2004).

The above literature review regarding the anxiety children experienced when completing NAPLAN formed the basis of the first research question in this study which was: *How has NAPLAN affected the student learning of mathematics?*

Changes in pedagogy in preparation for NAPLAN

Narrowing of the curriculum

The increased pressure placed on both teachers and students to achieve high results in NAPLAN (Howell, 2017; Huberty, 2004) has affected the learning of not only mathematics but an omission of teaching other learning areas, such as social sciences and arts which has reduced the encouragement of creativity and individuality (Goodwin, 2012; Thompson & Harbaugh, 2013; Smeed et al., 2009). Teachers are narrowing the curriculum, omitting these learning areas to find time to focus on practice NAPLAN testing (White & Anderson, 2012). The publication of results on the *My School* website has left teachers feeling pressured to ensure students are well prepared to sit NAPLAN (Dulfer et al., 2012; White & Anderson) as teachers only focused on learning areas that were being tested nationally. Teachers have reported that they are feeling pressure to teach to the test either by the pressure they have placed on themselves to ensure their students achieve well in NAPLAN, or being instructed to teach to the test. Consequently, this has resulted in a reduced amount of time spent on other learning areas and a lowered engagement of students (Thompson et al., 2013). Researchers have posited that there

should be further consultation with teachers to ascertain the needs of individual students and to ensure there is not a loss of high-order thinking skills (Smeed et al.).

Impact of changes in pedagogy

The common practice of teachers implementing practice tests to prepare their students for NAPLAN has been widely reported (Barrett, 2009; Dulfer et al., 2012; Jones & Hargrove, 2003; Nisbet, 2004; Perso, 2011; Ryan & Weinstein, 2009; Wilson & Hornsby, 2014). Research has also noted that classroom pedagogies have been altered by the use of practice tests in the preparation of NAPLAN (Minarechova, 2012; Thompson & Harbaugh, 2013). In the hope of ensuring students achieve high results in NAPLAN, teachers are spending an increased amount of time implementing practice tests by using past papers and focusing on the mechanics of filling in the test rather than the mathematical concepts within the test (Wilson et al, 2014). Dulfer et al. (2012) discovered that primary school teachers were implementing practice tests at least three times a week, with this occurrence increasing to six times a week just prior to the NAPLAN test.

Finding the balance between preparing students for NAPLAN and not teaching to the test is the dilemma that teachers of NAPLAN classes currently face, as teachers need to make decisions about what they will teach and the pedagogies they will implement (Perso, 2011). Teachers have felt frustrated by a perceived sense that they have lost the ability to choose appropriate pedagogy to teach mathematics by the need to address the content of the standardised test, rather than address the needs and interests of individual students (Barrett, 2009).

Research design

The research findings presented in this paper pertain to students' experiences of NAPLAN with a focus on the learning area of mathematics. The findings presented form part of a larger research project that sought to uncover the effect NAPLAN has on the teaching and learning of mathematics. As extant literature was clear in claiming that high-stakes testing has a negative impact on students, this investigation contributes to understanding student experiences of anxiety with high-stakes testing, from an Australian perspective. To best ascertain how students felt about NAPLAN and to gain an understanding of how NAPLAN affected the teaching and learning of mathematics, a qualitative approach to research design was selected. Qualitative research lends itself to investigations that seek to uncover the voice and experience of the participants (Stringer, 2008). Within a qualitative research design, a phenomenological theoretical perspective guided the investigation.

A theoretical perspective is a vehicle to inform the range of methodologies applied by researchers and phenomenology requires a researcher to engage with a phenomenon and to question understandings of that phenomenon (Crotty, 1998). Phenomenology also aims to determine the meaning of a phenomenon and ascertain how that meaning relates to participants' lives (Stringer, 2008). This study aimed to investigate the phenomenon of students' experiences of sitting NAPLAN and uncover an understanding of how it

affected their learning of mathematics. Phenomenology was applied in this study as the participants were asked to reflect on their life experiences of engaging with NAPLAN and share fresh perspectives of this phenomenon.

Within a phenomenological framework, a case study methodology was adopted to allow for the gathering of data within a particular context. A case study is described as allowing for a detailed investigation, over a period, within a particular context (Hartley, 2002). Utilising a case study design enabled the researchers to collect data from students in Years 3 and 5 of a primary school to discern their experiences of NAPLAN.

Students and teachers in Year 3 and Year 5 classrooms, as well as their parents and teachers at one Western Australian primary school formed the participant sample. The students were selected purposively, by their teacher, based on academic ability to ensure a variety of abilities were represented. Six children from Year 3 and six children from Year 5 were selected and all provided informed consent, along with their parents. The child participants included two students achieving results higher than their year level, two students achieving at the intended target for that year level, and two students achieving below the intended target. The researchers used semi-structured interviews with field notes to collect data for this research. Individual interviews were conducted face-to-face with students soon after the NAPLAN test had been administered and again after the results had been disseminated. Conducting interviews at this time allowed the researchers the best opportunity to ascertain a visceral account from all students regarding their perceptions of the testing phenomenon. Following a semi-structured format provided opportunities for the researchers to ask questions as they arose and to probe responses further, which is effective in gaining in-depth responses (Punch, 2009). The interview questions included asking students about their experiences of mathematics, compared to their experiences about mathematics within the NAPLAN test context. The interviews were recorded with a digital device so they could be transcribed and analysed. The researchers also took field notes during the interviews to note any salient observations or emerging thoughts arising during the interviews.

According to Stringer (2008), the ultimate goal of data analysis is to review the data collected to decide which elements best represent the goal of the research; this can be achieved by beginning with noteworthy responses from the participants and ensuring their voices are represented. Interviews were digitally recorded and transcribed. The researchers analysed the transcribed interviews and field notes according to a framework offered by Miles and Huberman (1994) which comprises the stages: data collection, data reduction, data display, and conclusion drawing/verification. Data collection was applied through the semi-structured interviews and researcher field notes. Collected data were condensed according to each participant group where common themes emerged. The data were then displayed through reading the text, and categorised into the responses of the participant groups. Within this analysis the processes of coding, memoing, and developing propositions were undertaken. Initially, individual transcripts were read and re-read in the process of coding revealing recurring themes. At this stage, memoing that had occurred during the data collection stage was integrated into the emerging themes to ensure researcher bias was avoided. Conclusions were then drawn and patterns were pinpointed

and formed. The emergent themes provide a collective account of students' common perspectives and experiences. Using this analytical process, the researchers were able to generate themes, and ultimately, key findings from the proffered information.

Findings and discussion

The findings presented in this paper stemmed from a larger study that investigated students', teachers', and parents' perspectives on how NAPLAN affected the teaching and learning of mathematics. This paper focused on the findings pertaining to the students' experiences of mathematics in NAPLAN which are presented as three themes, students' experiences with NAPLAN; the anxiety students experienced when sitting a high-stakes test; and the perceived change in teachers' pedagogy when it came to NAPLAN. The findings presented below represent results from students who were deemed high, average and below average achieving students. As both the Year 3 and Year 5 cohorts presented similar perceptions of NAPLAN, and there did not appear to be any distinctions between the cohorts, the findings have been integrated.

Students' experiences with NAPLAN

The first emergent theme was the extent to which the students' enjoyment of mathematics was affected by NAPLAN. A majority of students stated that they really enjoyed their mathematics lessons but that they had noticed their lessons altered in the lead-up to NAPLAN. These students relayed that they preferred the classes that were not based on NAPLAN preparation. Haladyna et al. (1998) observed that high-stakes testing can increase the anxiety of the test situation and therefore detract from the enjoyment of learning. Goodwin (1993) stated that a focus on results can significantly decrease the motivation and self-esteem of children. The results of this study did not support Goodwin's (1993) assertions. Students in this investigation indicated that they had a very positive attitude towards mathematics both before and after NAPLAN. This positive attitude is evidenced by students when questioned about their perceptions of mathematics lessons:

I love it, and I am really enjoying my maths teacher this year. I like maths (Student 3A)

I like it because I get to learn new times tables and I am really good at them because I know them off by heart (Student 3B)

It's fun doing hard sums because I like to give it a go, I keep trying until I think I can get it right (Student 5B)

Such a positive attitude may be connected to the lack of pressure placed on students by the teachers to achieve high NAPLAN results. This finding may indicate that if this school can present NAPLAN in an affirmative fashion it is possible for other schools to follow suit.

The anxiety students experienced

Findings from this investigation illustrated that the level of anxiety experienced by students in Years 3 and 5 was low, and generally the interviewed students reported feeling well prepared and not anxious about completing NAPLAN. Such an experience was characterised by most students stating that they felt both nervous and happy. For example, students made statements such as:

- ... I was a bit nervous at first, but you know it's not going to affect your results from school, so that is a bit of pressure taken off, your teacher reassures you that it isn't going towards your results (Student 5A)
- ... a little nervous and happy, I like doing tests (Student 3B)
- ... just a little nervous. She [the teacher] tells us not to worry...(Student 3C)
- ... I get just a little anxious... (Student 5D)

One of the negative consequences that received frequent mention in existing literature was the anxiety experienced by participants during NAPLAN and other high-stakes tests. This anxiety included anxiety related to sitting the test, anxiety associated with achieving high results and anxiety associated with the test conditions (Bagnato & Yeh Ho, 2006; Huberty, 2004). Many authors contended that most of this anxiety was related to the pressure to do well on the test (Bagnato & Yeh Ho, 2006; Goodwin, 2012; Haladyna, 2011; Huberty, 2009; Paris & McEvoy, 2000). In this investigation the finding that anxiety experienced by students was low, sits in opposition to current research such as Bagnato and Yeh Ho (2006) who stated that in both younger (seven to eight year olds) and older children, a heightened level of anxiety existed when completing high-stakes testing. The lack of anxiety exhibited by students in this study in sitting the test seemed to be engendered by the teachers' reassurance that the results were not important and that they did not relate to their school achievements. The lack of anxiety exhibited by these children may also indicate that the students were more concerned about their school results rather than attaining high NAPLAN scores as illustrated in Student 5A's response.

A further source of anxiety for students sitting high-stakes tests is identified in current literature as the time limitations of high-stakes tests (Carter, 2012; Davidson, 2009). Existing research outlines the pressure to complete tests in a certain time frame is not conducive to students accomplishing their best results (Carter, 2012; Davidson, 2009). This finding was reinforced by the students in this investigation who indicated that they felt concerned if they had to skip a question and come back to it, as they were unsure if they would be able to achieve this within the time constraints of NAPLAN. For example, Student 5D recalled that

- I get just a little anxious if I go and don't get the question and I skip it and don't get time to go back (Student 5D)

A common practice during regular mathematics lessons would be to encourage students to revisit questions they did not finish, and to check their answers. Further, it would also be a goal of any teacher writing a test to ensure students could complete the test within the time frame of the lesson, hence limiting the time pressure placed on students.

Perceived changes in teachers' pedagogy

Despite students admitting minimal concern about the results of NAPLAN, there was some anxiety expressed by participants about the test conditions they were placed under when sitting the standardised test. Most of this anxiety related to the physical layout of the classroom and the timing restraints of the test. Student responses indicated that changes in the physical environment caused concern for them and their classmates; alterations in the class setting evoked feelings of uncertainty and nervousness. The analysis of the field notes revealed the following, "Students recalled the classes changing as they stated that one-week classes were normal then the next week there were NAPLAN-based lessons". To further illustrate this theme, Student 3F expressed the feeling of isolation as the classroom layout altered from group seating to individual rows:

I felt a bit nervous and insecure because I felt like it was only me getting tested and no one else (Student 3F)

From the results of this research, it is apparent that teachers do alter the mathematics environment and students are aware of these changes. Such changes in the mathematics environment and students' awareness of these changes was again confirmed by the researchers' field notes which were taken during the semi-structured interviews. Student 3E recalled that she did not like the mathematics lessons pertaining to NAPLAN as they were "boring and I don't like it when we move the desks into rows". This alteration of the environment manifests in students' diminished enjoyment of mathematics lessons. A discussion point from this finding is that educators need to question the overall test preparation for NAPLAN. If teachers believe in student-directed lessons, which are employed in 'non-NAPLAN' lessons, then perhaps they may continue this pedagogy throughout the preparation for NAPLAN. Adhering to usual classroom practices may develop further confidence in students and consequently improve results. The notion that the foreign nature of the physical setting of the classroom produced stress in primary aged children is supported by Bagnato and Yeh Ho (2006).

Such test conditions are decontextualised from the usual daily activities as young children typically do not display their best abilities by sitting quietly at tables. As previously mentioned, the physical environment of the classroom was altered from small groups to individual desks in rows to meet the requirements set out by ACARA. The changes in the physical environment had an effect on the pedagogies implemented in the weeks prior to NAPLAN. A less collaborative approach to learning was implemented, resulting in a reduced ability to allow students to discuss learning during mathematics lessons, and a classroom environment that was uncondusive to students asking for assistance.

The changes in the way students learn mathematics in the lead-up to NAPLAN and regular classroom lessons was evident through this investigation. The major change was demonstrated through regular mathematics lessons being replaced by opportunities to complete practice NAPLAN tests. When asked if mathematics lessons had been altered in the lead-up to NAPLAN, students specified that teachers altered the mathematics lessons to focus on the content of the NAPLAN test. According to student testimony, it is

apparent that teachers moved away from their usual mathematics lessons to concentrate on NAPLAN practice tests. In analysing field notes pertaining to this research question, the change in pedagogy was confirmed, where one student stated that during NAPLAN preparation lessons the “sums got harder”. Teachers focusing on how to complete the test, is a concern raised by Wilson and Hornsby (2014) who outlined that Year 3 and Year 5 teachers are required to provide practice tests for their students for many weeks prior to the tests.

It can be concluded then, that the implementation of practice tests would influence the learning of mathematics. If students are engaging in practice tests under test conditions, then this practice is a departure from usual classroom practices in mathematics. Students would not necessarily be concentrating on mathematics skills but rather concentrating on understanding how to navigate the actual mechanics of the test. According to Thompson and Harbaugh (2013), focusing on sample tests could result in less time spent on higher-order thinking skills, and fewer opportunities for conversation between teachers and students. According to the student participants, changes in pedagogy not only affected the learning of mathematics but also contributed to a reduced enjoyment of mathematics lessons in the lead-up to NAPLAN. The students in this investigation generally expressed that they enjoyed mathematics classes, but there was evidence that this enjoyment was reduced during preparation for NAPLAN.

Limitations of the research

Three main limitations were evident in this study. The first limitation was the limited number of schools that were involved in this study; however, it is important to note that the school chosen was a large school and had three classes of each grade which allowed for a larger selection of participants. The 12 students were randomly chosen by the teacher to represent the students in this classroom, there was no bias as to how the students were chosen. The only stipulation was that the students represented high, average, and below average performing students. The second limitation was that 7 and 8 year-old students were interviewed. Consequently, the young students may not have fully understood the question or felt a bit nervous in an interview situation. These issues were addressed by the researcher allowing students to have their classroom teacher in the interview if that made them feel more comfortable and ensuring students understood the questions by repeating them or rewording the questions. The final limitation was that a large majority of the literature discussed the negative aspects of NAPLAN, which made it difficult to present a balanced view about the anxiety students experienced. All efforts were made to conduct an extensive literature review to present a balanced view of students' experiences in NAPLAN.

Implications and recommendations

There are a variety of implications for the children's learning that have emerged from this research. Firstly, due to the change in pedagogical approaches, children may miss out on a wide range of collaborative learning strategies in the lead-up to NAPLAN, as teachers alter their teaching approaches to prepare the students for the test. This period of

preparation may also lead to areas of the curriculum not being covered in Years 3 and 5 as teachers spend time implementing NAPLAN practice tests. This narrowing of the curriculum may extend to the curriculum in other learning areas being neglected. It is evident through the existing literature, that students do experience some level of anxiety when they are involved in NAPLAN.

Students in this study indicated that they thoroughly enjoyed mathematics lessons and displayed positive self-esteem about their own mathematical abilities. However, these same students admitted that their enjoyment of mathematics was reduced once lessons were altered in preparation for NAPLAN. This finding should act as a salutary lesson to teachers. A recommendation arising from this investigation is that students could be involved in discussions with teachers to understand that NAPLAN is only one indication of their mathematical abilities. As a consequence of these discussions, students can be aware that the reporting of their mathematical achievements is taken over a whole year through a variety of diagnostic, formative and summative assessments. As stated in the recent review on NAPLAN, the results of the test should serve as a snapshot of students' capabilities and teachers' regular observations and assessments over the course of a year should also be taken into account when acknowledging student achievements in numeracy (McGaw et al., 2020). Students, with the guidance of their teachers, should be encouraged to approach NAPLAN without anxiety.

Conclusion

In the age of standardised high-stakes testing, there is a multitude of literature espousing the heightened state of anxiety experienced by students sitting these tests, including physical manifestations and effects on their well-being (Bagnato & Yeh Ho, 2006; Haladyna, 2011; Huberty, 2004; Paris & McEvoy, 2000). Findings from this study suggest that if teachers do not place pressure on students, and in fact, do not feel the pressure themselves, then their students could experience less anxiety in the lead-up to NAPLAN. The only pressure indicated by students in this study was related to the changes in the physical environment and the requirement to complete NAPLAN under time constraints. These findings raise questions about the learning of mathematics in the lead-up to NAPLAN. Could educators assist in reducing students' feelings of anxiety due to time constraints, by completing mathematics activities under time pressure but not necessarily through NAPLAN practice tests? Or could governing bodies such as ACARA consider changing the conditions of NAPLAN by not insisting through the National protocols that students sit in rows and be under time restraints? Further, could teachers prepare students for the concepts presented in NAPLAN through regular classroom practices that are child-centred and collaborative rather than engaging in practice tests? These are important questions that require attention from school leaders if these high-stakes tests continue to find a place in schools.

References

- ACARA (Australian Curriculum Assessment and Reporting Authority) (2016). *Assessment*. <https://www.acara.edu.au/assessment>
- Attard, C., Ingram, N., Forgasz, H., Leder, G. & Grootenboer, P. (2016). Mathematics education and the affective domain. In *Research in Mathematics Education in Australasia 2012-2015* (pp. 73-96). Springer. https://doi.org/10.1007/978-981-10-1419-2_5
- Bagnato, S. J. & Yeh-Ho, H. (2006). High-stakes testing with preschool children: Violation of professional standards for evidence-based practice in early childhood intervention. *KEDI International Journal of Educational Policy*, 3(1), 22-43. <https://www.proquest.com/docview/1013969816>
- Barrett, B. D. (2009). No child left behind and the assault on teachers' professional practices and identities. *Teaching and Teacher Education*, 25(8), 1018-1025. <https://doi.org/10.1016/j.tate.2009.03.021>
- Belcastro, L. & Boon, H. (2012). Student motivation for NAPLAN tests. *Australian and International Journal of Rural Education*, 22(2), 1-19. <https://search.informit.org/doi/epdf/10.3316/aiect.193270>
- Carter, M. (2012). Time limitations in NAPLAN numeracy tests. *Australian Mathematics Teacher*, 68(1), 36-40. <https://eric.ed.gov/?id=EJ974980>
- Cranley, L. (2018). *An investigation into the impact of high-stakes testing, through the NAPLAN assessment, on the teaching and learning of mathematics in one primary school*. Master of Philosophy dissertation, The University of Notre Dame Australia. <https://researchonline.nd.edu.au/theses/204/>
- Crotty, M. (1998). *The foundations of social research: Meaning and perspective in the research process*. SAGE. <https://doi.org/10.4324/9781003115700>
- Davidson, J. (2009). NAPLAN or napalm? Using the new national tests to personalise learning. *Teacher Learning Network*, 16(1), 3-5. [abstract only] <https://www.semanticscholar.org/paper/NAPLAN-or-napalm-Using-the-new-national-tests-to-Davidson/d8f22eea78622bffe261badecf80e2c8971aab19>
- Dulfer, N., Polesal, J. & Rice, S. (2012). *The experience of education: The impact of high stakes testing on school students and their families*. Whitlam Institute, University of Western Sydney. <https://www.whitlam.org/publications/2017/10/17/an-educators-perspective-the-impacts-of-high-stakes-testing-on-school-students-and-their-families>
- Ferguson, B. (2019). With NAPLAN testing less than a month away anxiety is increasing for many students. In *Seven News*, 23 April. <https://www.facebook.com/watch/?v=419042082216047>
- Goodwin, C. (1993). Recording human interaction in natural settings. *Pragmatics*, 3(2), 181-209. <https://doi.org/10.1075/prag.3.2.05goo>
- Goodwin, T. (2012). Why we should reject 'nudge'. *Politics*, 32(2), 85-92. <https://doi.org/10.1111/j.1467-9256.2012.01430.x>
- Grieve, S. (2012). Time to scrap NAPLAN. *Independent Education*, 42(2), 15. https://issuu.com/ieunswact/docs/ie_magazine_vol42_2012/1
- Haladyna, T. (2011). Using students' achievement tests to evaluate teachers – a very bad idea. *Nonpartisan Education Review*, 7(2), 1-3. <http://www.nonpartisaneducation.org/Review/Essays/v7n2.pdf>
- Haladyna, T., Haas, N. & Allison, J. (1998). Continuing tensions in standardized testing. *Childhood Education*, 74(5), 262-273. <https://doi.org/10.1080/00094056.1998.10521950>

- Hardy, I. (2014). A logic of appropriation: Enacting national testing (NAPLAN) in Australia. *Journal of Education Policy*, 29(1), 1-18.
<https://doi.org/10.1080/02680939.2013.782425>
- Huberty, T. J. (2004). *Anxiety and anxiety disorders in children: Information for parents*. National Association of School Psychologists. https://www.apsva.us/wp-content/uploads/2016/07/anxiety_and_anxiety_disorders_in_children.pdf
- Huberty, T. J. (2009). Test and performance anxiety. *Principal Leadership*, 10(1), 12-16.
https://www.nasponline.org/Documents/Resources%20and%20Publications/Handouts/Families%20and%20Educators/Anxiety_NASSP_Oct09.pdf
- Howell, A. (2017). 'Because then you could never ever get a job!': Children's constructions of NAPLAN as high-stakes. *Journal of Education Policy*, 32(5), 564-587.
<https://doi.org/10.1080/02680939.2017.1305451>
- Jones, M. G., Jones, B. D. & Hargrove, T. (2003). *The unintended consequences of high-stakes testing*. Rowman & Littlefield. <https://rowman.com/ISBN/9781461715474/The-Unintended-Consequences-of-High-Stakes-Testing>
- Khanam, K. & Nghiem, S. (2018). Behavioural and emotional problems in children and educational outcomes: A dynamic panel data analysis. *Administration and Policy in Mental Health and Mental Health Services Research*, 45(3), 472-483.
<https://doi.org/10.1007/s10488-017-0837-7>
- Lingard, B. (2009). Testing times: The need for new intelligent accountabilities for schooling. *QUT Professional Magazine*, 24, 13-19.
https://www.academia.edu/27162545/Testing_times_The_need_for_new_intelligent_accountabilities_for_schooling
- Mayes, E. & Howell, A. (2018). The (hidden) injuries of NAPLAN: Two standardised test events and the making of 'at risk' student subjects. *International Journal of Inclusive Education*, 22(10), 1108-1123. <https://doi.org/10.1080/13603116.2017.1415383>
- McGaw, B., Louden, W. & Wyatt-Smith, C. (2020). *NAPLAN Review: Final report*. https://naplanreview.com.au/pdfs/2020_NAPLAN_review_final_report.pdf
- Miles, M. B. & Huberman, M. A. (2004). *Qualitative data analysis: An expanded sourcebook* (2nd ed). SAGE. [4th ed.] <https://us.sagepub.com/en-us/nam/qualitative-data-analysis/book246128>
- Minarechová, M. (2012). Negative impacts of high-stakes testing. *Journal of Pedagogy / Pedagogický Casopis*, 3(1), 82-100. <https://doi.org/10.2478/v10159-012-0004-x>
- NAP (National Assessment Program) (2016). *National protocols for test administration*. <https://www.nap.edu.au/naplan/for-schools/national-protocols-for-test-administration>
- Neisworth, J. T. & Bagnato, S. J. (2004). The mismeasure of young children: The authentic assessment alternative. *Infants and Young Children*, 17(3), 198-212.
https://journals.lww.com/iyjournal/Abstract/2004/07000/The_MisMeasure_of_Young_Children__The_Authentic.2.aspx
- Nisbet, S. (2004). The impact of state-wide numeracy testing on the teaching of mathematics in primary schools. In M. Hoines & A. Fuglestad (Eds.), *Proceedings of the 28th Conference of the International Group for the Psychology of Mathematics Education (PME)* (Vol. 3, pp. 433-440). Norway: PME. <https://files.eric.ed.gov/fulltext/ED489602.pdf>
- O'Keeffe, D. (2011). NAPLAN nightmares. *Education Review*, 11 August.
<https://www.educationreview.com.au/2011/08/naplan-nightmares/>

- Paris, S. & McEvoy, A. (2000). Harmful and enduring effects of high stakes testing. *Issues in Education*, 6(1/2), 145-160.
- Perso, T. (2011). Assessing numeracy and NAPLAN. *Australian Mathematics Teacher*, 67(4), 32-35. <https://eric.ed.gov/?id=EJ956716>
- Punch, K. F. (2009). *Introduction to research methods in education*. SAGE. [2nd ed.] <https://us.sagepub.com/en-us/nam/introduction-to-research-methods-in-education/book239756>
- Ragusa, A. T. & Bousfield, K. (2017). 'It's not the test, it's how it's used!' Critical analysis of public response to NAPLAN and MySchool Senate Inquiry. *British Journal of Sociology of Education*, 38(3), 265-286. <https://doi.org/10.1080/01425692.2015.1073100>
- Roberts, P., Barblett, L. & Robinson, K. (2019). Early years teachers' perspectives on the effects of NAPLAN on stakeholder wellbeing and the impact on early years pedagogy and curriculum. *Australasian Journal of Early Childhood*, 44(3), 309-320. <https://doi.org/10.1177/1836939119855562>
- Rudd, K. & Smith, S. (2007). *The Australian economy needs an education revolution*. Canberra: Australian Labor Party. https://australianpolitics.com/downloads/alp/2007/07-01-23_education-revolution.pdf
- Ryan, R. M. & Weinstein, N. (2009). Undermining quality teaching and learning: A self-determination theory perspective on high-stakes testing. *Theory and Research in Education*, 7(2), 224-233. <https://doi.org/10.1177/1477878509104327>
- Smeed, J., Spiller, K. & Kimber, M. (2009). Issues for principals in high-stakes testing. *Principal Matters*, 81, 32-34. <https://eprints.qut.edu.au/29254/1/c29254.pdf>
- Stringer, E. T. (2008). *Action research in education* (2nd ed.). Pearson. [4th ed.] <https://us.sagepub.com/en-us/nam/action-research/book236795>
- Swain, K. & Pendergast, D. (2018). Student voice: Student feelings as they journey through National Assessment (NAPLAN). *The Australian Journal of Education*, 62(2), 108-134. <https://doi.org/10.1177/0004944118779602>
- Swain, K., Pendergast, D. & Cumming, J. (2018). Student experiences of NAPLAN: Sharing insights from two school sites. *The Australian Educational Researcher*, 45(3), 315-342. <https://doi.org/10.1007/s13384-017-0256-5>
- Thompson, G. & Harbaugh, A. G. (2013). A preliminary analysis of teacher perceptions of the effects of NAPLAN on pedagogy and curriculum. *The Australian Educational Researcher*, 40(3), 299-314. <https://doi.org/10.1007/s13384-013-0093-0>
- White, P. & Anderson, J. (2011). Teachers' use of national test data to focus numeracy instruction. In J. Clark, B. Kissane, J. Mousley (Eds.), *Mathematics: Traditions and [new] practices*. Proceedings of the 2011 AAMT-MERGA conference (pp. 777-785). https://www.merga.net.au/Public/Public/Publications/Annual_Conference_Proceedings/2011_MERGA_CP.aspx
- Wilson, L. & Hornsby, D. (2014). Teaching to the test. *Practically Primary*, 19(2), 41-43. <https://search.informit.com.au/fullText;dn=322490650171533;res=IELHSS>
- Wilson, R., Piccoli, A., Hargreaves, A., Ng, P. T. & Sahlberg, P. (2021). *Putting students first: Moving on from NAPLAN to a new educational assessment system* (The Gonski Institute Policy Paper #2-2021). Sydney: UNSW Gonski Institute for Education. https://www.gie.unsw.edu.au/sites/default/files/documents/Putting%20Students%20First_final.pdf

Linda Cranley is the coordinator of the Bachelor of Education (Primary) degree at the University of Notre Dame Australia. Linda holds an MPhil from The University of Notre Dame Australia with research conducted into the impact of standardised testing (the National Assessment Program Literacy and Numeracy). Linda is currently completing a PhD investigating active and informed citizenship in the Foundation to Year 2 classroom.

ORCID: <https://orcid.org/0000-0003-0008-4542>

Email: linda.cranley@nd.edu.au

Dr Christine Robinson is the coordinator of the early childhood programs including the Bachelor of Education (Early Childhood & Care: 0-8 years), the Graduate Certificate in Early Childhood and the MEd (Early Childhood). Christine holds a PhD in young children's spirituality from University of Notre Dame Australia.

ORCID: <https://orcid.org/0000-0002-8938-2994>

Email: christine.robinson@nd.edu.au

Dr Gregory Hine's teaching career spans 22 years. He has taught in Australia and the United States, predominantly in the areas of mathematics, science, and religious education, to middle and high school students. In 2011 Greg was appointed to an academic position in the School of Education, University of Notre Dame Australia.

ORCID: <https://orcid.org/0000-0003-4589-3159>

Email: gregory.hine@nd.edu.au

Dr Dee O'Connor is an Associate Professor of Education at University of Notre Dame Australia. Dee has a professional background of pedagogical and leadership roles within early childhood education policy and practice. Dee's research interests relate to holistic early learning and development, learning environments, outdoor learning and nature pedagogy.

ORCID: <https://orcid.org/0000-0001-8710-4571>

Email: dee.oconnor@nd.edu.au

Please cite as: Cranley, L., Robinson, C., Hine, G. & O'Connor, D. (2022). The desks have changed; it must be NAPLAN time: How NAPLAN affects teaching and learning of mathematics. *Issues in Educational Research*, 32(4), 1306-1320.

<http://www.iier.org.au/iier32/cranley.pdf>