

Mind the Gap

3 January 2017 to 31 March 2018

Ann Jardine, University of New South Wales

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Higher Education Participation and Partnerships Programme (HEPPP)

2016 National Priorities Pool FINAL REPORT

Mind the Gap

3 January 2017 to 31 March 2018

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In accordance with the Conditions of Grant, you must submit to the Department a Final Report (Clause 6.1 of Part A) and an Acquittal Report (clause 6.4 of Part A).

To meet this obligation, please submit:

- the completed **Final Report** template, in Word and PDF
- the completed and signed **Declaration** form, in PDF
- the completed **Acquittal Report** template, in Excel and PDF.

All documents must be submitted to equity@education.gov.au by **31 March 2018**.

If you require additional guidance or clarification, please contact us at equity@education.gov.au.

Contents

List of Tables	3
1. PROJECT SUMMARY (Conditions of Grant, clause 2.2 of Part A)	5
Objectives	5
Project Activities, Milestones and Key Performance Indicators.....	6
Highlights and Issues	8
Outcomes.....	9
Summary.....	9
Issues	9
2. OTHER PROJECT MATERIAL (Conditions of Grant, clause 2.2 of Part A)	11
3. ACQUITTAL REPORT (Conditions of Grant, clause 6.4 (a)-(d), clause 6.5 (a)-(b) of Part A)	12
DECLARATION	13
APPENDIX: Calculating the effectiveness of university widening participation activities on the academic attainment of rural Australian students	14
Widening participation in Australian higher education	14
Efforts to evaluate university widening participation activities	15
Prelude to methodology: addressing issues and complexities in widening participation effectiveness evaluations	16
Multilevel modelling.....	16
Mixed methods	17
Methodology.....	17
Data and variable acquisition for statistical modelling	18
Calculating outreach program impact.....	19
Statistical modelling of quantitative data	22
Interview performance and analysis	23
Results.....	24
Discussion points.....	25
Opposing quantitative and qualitative ‘evidence’	26
Exploring the disconnect between teacher beliefs and statistical outcomes.....	27
Conclusions	28
References	29

List of Tables

Table 1: Project objectives	5
Table 2: Project activities, milestones and KPIs	6
Table 3: Additional materials produced over the course of the project	11
Appendix Table 1: Sample demographics categorised by predictor types.	19
Appendix Table 2: Themes and subthemes customarily addressed by university widening participation schools outreach activities and programs. Italicised words represent variable name in modelling.	20
Appendix Table 3: Impact scoresheet showing aggregated practitioner impact ratings.	21
Appendix Table 4: The number of NSW rural schools receiving outreach per year and associated impact score.	22

Appendix Table 5: Fixed effect estimates with standard errors in parentheses
for final iteration of multilevel growth models..... 25

Appendix Table 6: Interview participant’s beliefs about the best way to
motivate rural students to go to university. 27

1. PROJECT SUMMARY (Conditions of Grant, clause 2.2 of Part A)

Objectives

Table 1: Project objectives

IDENTIFIED OBJECTIVE	EXTENT TO WHICH THE OBJECTIVE WAS MET
investigate whether Australian university widening participation initiatives are addressing the attainment gap that exists for low SES students in regional and remote schools	The research questions were thoroughly investigated using a mixed methods approach that incorporated statistical multilevel growth modelling with interview narrative analysis. Quantitative results showed that university widening participation (WP) programs that aim to boost parental and/or community involvement and support were the activities found to have significant influence on academic attainment between 2010 and 2016. Regardless of this influence, academic attainment numbers were static for this period. Interviews with teachers indicated teacher belief in the ability of university WP initiatives to help their students. Teachers thought WP initiatives presented a positive presence in their schools but tended to associate WP initiative success with broadening student experiences, for example, rather than raising student attainment.
examine and identify any trends in attainment levels in regional and remote schools;	Statistical modelling found attainment levels to be static in rural NSW government secondary and central schools between 2010 and 2016. Static attainment levels were corroborated by teachers during interviewing. Modelling did identify factors capable of impact attainment, these included: rurality (school location), distance to nearest university campus, school type (secondary or central), school population, year 12 cohort size, school ICSEA score and school EAS status.
examine any differences between schools known to have had sustained engagement with widening participation activities and others.	Interviews with teachers revealed a fondness for WP initiatives accompanied by a belief that their school would be worse off without a university WP presence. Most teachers spoke of a desire to maintain and expand WP presence in their schools and most suggested that their students enjoyed their interactions with WP programs. Statistical modelling showed no statistically significant difference in attainment levels between schools based on amount of contact with WP initiatives.

Project Activities, Milestones and Key Performance Indicators

Table 2: Project activities, milestones and KPIs

TIME FRAME	PLANNED ACTIVITIES & MILESTONES	PROJECT ACTIVITIES & MILESTONES COMPLETED	IDENTIFIED KEY PERFORMANCE INDICATORS	KEY PERFORMANCE INDICATORS OUTCOME
Nov 2016 – Dec 2016	1.1 Project Officer recruitment.	Project Officer with PhD and research skills in both qualitative and quantitative methodologies recruited	1.1 Appointment of a Project Officer with the knowledge, skills and experience to successfully deliver the project.	Completed Project officer recruited and commenced initial work in late November 2016.
	1.2 Submission of application for ethics approval to the University of New South Wales.	Ethics approval sought from both UNSW and subsequently the appropriate area of NSW Department of Education	1.2 Application for ethics approval submitted in sufficient time for approval to be granted by mid-February 2017.	Completed UNSW ethics approved (HC16975) and NSW Department of Education SERAP approved (2017070)
Nov 2016 – Dec 2016	2.1 Review of international literature on the successes of widening participation programs and how they have been evaluated in terms of educational outcomes.	A comprehensive international literature review conducted.	2.1 Completion of literature review informs project processes and identifies any potential new data sources: <ul style="list-style-type: none"> any identified and new data sources will form part of the ongoing discussions with the NSW Department of Education (DET). 	Completed Literature review undertaken and completed. Literature review was constantly updated through the project life and then used to write an article for journal publication.
	2.2 Data identification.	Completed Conversations were held with DET re data sources. Subsequently data was gained from ACARA as they were holders of the data required	2.2 Identification of available data relevant to the Project.	Completed Data sources identified within UAC, UNSW student information system and ACARA.
Jan 2017 – Feb 2017	3.1 Investigation of new potential data sources.	Several meetings with the NSW DET were undertaken to source data. Other external sources such as ACARA were also identified	3.1 Consultations on potential new data sources conducted with: <ul style="list-style-type: none"> NSW DET to identify aggregate schools data they are willing to share. up to 10 schools in regional and remote NSW that 	Completed NSW DET provided some data to project researchers. In addition, as a result of discussions researchers and DET decided to include interview aspect into research methods.

TIME FRAME	PLANNED ACTIVITIES & MILESTONES	PROJECT ACTIVITIES & MILESTONES COMPLETED	IDENTIFIED KEY PERFORMANCE INDICATORS	KEY PERFORMANCE INDICATORS OUTCOME
			are part of the ASPIRE program. These schools are designated low SES and have traditionally had both low progression rates to university and low High School Median ATAR.	
Feb 2017 – May 2017	<p>4.1 Data collation, including:</p> <ul style="list-style-type: none"> all NSW regional and remote state schools that using FOEI fall within the bottom two quartiles; 5 years of available data for students (defined as current school leavers), including individual ATARs, High School Median ATAR and university offers; any other relevant data sources identified in the course of the project; and an environmental scan of university equity websites to identify partner schools involved in widening participation outside the ASPIRE program. 	Both qualitative and quantitative data were collected. Quantitative data included academic attainment indicators of ATAR eligibility count, application, offer and enrolment counts for all rural NSW government secondary and central schools. Qualitative data were collected from regional school teachers, Data was also collected via a survey from NSW universities on outreach activities	4.1 Completion of data collation.	<p>Completed</p> <p>Quantitative data collated from data sources and organised for later analyses. Academic attainment indicators of ATAR eligibility count, application, offer and enrolment counts for all rural NSW government secondary and central schools were collected for the period of 2010 to 2016. Interviews were undertaken with teachers at 35 rural NSW government schools across an area one seventh the size of NSW. Interviewed schools included 15 ASPIRE and 20 non-ASPIRE schools. Surveys returned from nine NSW universities with two declining to provide information.</p>
Jun 2017 – Oct 2017	5.1 Data input and analysis to examine whether any patterns in academic achievement at an aggregate level can be identified.	Appropriate qualitative and quantitative analyses tools were identified to be used	<p>5.1.1 Completion of data input.</p> <p>5.1.2 Completion of data analysis (all relevant tests run) using quantitative statistical methods to identify trends and patterns.</p> <p>5.1.3 Identification of findings.</p>	<p>Completed</p> <p>Data input and analysed using multilevel growth models and the PROC MIXED function in SAS Enterprise Guide. Recorded interviews were transcribed then data were thematically coded in NVivo.</p>

TIME FRAME	PLANNED ACTIVITIES & MILESTONES	PROJECT ACTIVITIES & MILESTONES COMPLETED	IDENTIFIED KEY PERFORMANCE INDICATORS	KEY PERFORMANCE INDICATORS OUTCOME
Oct 2017 – Dec 2017	6.1 Publication and dissemination of results.	An appropriate Australian conference held towards the end of the project was identified and a presentation submitted	6.1.1 A conference paper presenting the Project outcomes is prepared and targeted for submission to an appropriate conference.	Completed Progressing work was presented at the 2017 EPHEA conference. The presentation was titled: Efforts to quantify the effectiveness of university widening access programs in the context of provincial NSW government schools.
		Possible journals were identified for a paper submission.	6.1.2 A journal article presenting the Project outcomes is prepared and targeted for submission to an appropriate peer-reviewed journal.	Completed Journal article has been prepared for submission for review to Studies in Higher Education journal.
		Final report and acquittal prepared	6.1.3 Final Report and Acquittal Report submitted to the Department of Education and Training.	Completed Final report and acquittal written

Highlights and Issues

Highlights are demonstrated through key research findings from the project:

- WP initiatives are regarded very favourably but valued in diverse ways by regional and remote teachers. Value tended not to be in regards to WP programs raising academic attainment. Quantitative evidence supported this finding by illustrating the negligible impact of WP activities on regional and remote government school attainment levels between 2010 and 2016.
- Results suggest that WP activities aimed at boosting parental and/or community involvement and support represented the single type of WP activity to have a statistically significant influence on attainment numbers within the study period.
- Analysis of teacher interviews suggested a latent ambivalence regarding the effectiveness of WP initiatives to raise academic attainment in rural schools. Teachers held near universal positive feelings for WP presence within their schools but highlighted other reasons for why WP programs are helpful. Teachers believed WP programs are good at extending student experiences outside their communities and comfort zones without directly attributing these benefits to improving their academic attainment outcomes.

- Multilevel growth modelling revealed a number of predictor variables capable of influencing attainment levels in rural NSW government secondary and central schools. Significant predictors included: rurality (school location), distance to nearest university campus, school type (secondary or central), school population, year 12 cohort size, school ICSEA score and school EAS status.
- Divergent outcomes from empirical quantitative and qualitative results suggest the need for further research.
- The particular methods used to investigate the project aims brought to light discourse that would likely otherwise have been missed with a less rigorous approach.

Outcomes

The project uncovered evidence supporting the amplification of WP efforts to boost parental and/or community involvement and support. Actionable outcomes from this project are likely to be implemented following discussions with WP practitioners within the institution.

There is much scope for further work in this area to be undertaken within the Australian context.

Did you undertake an evaluation of your project?

Yes No

Not applicable.

Summary

Project outcomes are presented and explored in detail within the accompanying research article. A confidential draft of the research article has been attached in compliance with section 6.1 C in Part A of the Conditions of Grant.

Student contacts	N/A
Journal (or other publication) submissions	1 to be submitted
Conference Presentations	1 2017 EPHEA Conference
Websites developed	N/A
Educational or marketing campaigns	N/A
Community organisations engaged	N/A
Schools engaged	35
Parental/family contacts	N/A

Issues

- Amendments were made to the UNSW ethics human ethics panel following the decision to include teacher interviews in the research methods. The amendments

were made and accepted without issue. Also, SERAP ethics was required for teacher interviewing, and it too was approved without issue following submission.

- Data were initially collected for the years 2012 to 2016. It was later decided that data back to 2010 would be included in analyses. This required multiple request to external data sources to provide the required information.
- WP practitioners at 11 NSW universities were surveyed as part of the methodology to quantify WP contact within schools from 2010 to 2016. The process was arduous, and requested data was slow in being returned. Two universities refused to participate, and a couple did so after months of deliberating. The time delays made this part of the project the most difficult. A mitigation strategy involved trawling the web for available data where data were not returned from universities.

2. OTHER PROJECT MATERIAL (Conditions of Grant, clause 2.2 of Part A)

Table 3: Additional materials produced over the course of the project

TYPE	AUTHOR	DATE OF PUBLICATION	PUBLICATION DETAILS
EPHEA 2017 conference PowerPoint presentation	Todd Walton		Unpublished conference slides

3. ACQUITTAL REPORT (Conditions of Grant, clause 6.4 (a)-(d), clause 6.5 (a)-(b) of Part A)

Have you fully expended the Grant Funds provided under the Conditions of Grant?

Yes No

If the answer is No, please specify:

- *the amount of funds remaining: \$*
- *the reason for this underspend:*

**IMPORTANT NOTICE - Unspent 2016 National Priorities Pool Grant Funds*

- *Grant recipients must fully expend these 2016 National Priorities Pool funds in the project period for which the grant is made and report on this expenditure to the Commonwealth, including the amount of any unspent funds.*
- *If a provider fails to spend the full amount granted it in respect of a year, the unspent funds may be recovered by the Commonwealth.*

DECLARATION

I declare that:

- I am authorised by the university to sign this Declaration on its behalf, and to the best of my knowledge, the information that I have provided in the **Final Report** and **Acquittal Report** for the HEPPP 2016 National Priorities Pool project: *Mind the Gap* is true, correct and accurate in all particulars.

I understand that:

- The provision of false or misleading information or the making of false or misleading statements to the Commonwealth is a serious offence under the *Criminal Code Act 1995 (Cth)*.
- If any actual or potential conflict of interest arises, I must notify the Commonwealth immediately in writing of the facts giving rise to the actual or potential conflict of interest and to take such steps as the Commonwealth may require so as to resolve or otherwise deal with any conflict of interest that may arise.

I agree to publication of the Final Report on the Department of Education and Training website, once accepted by the department.

Title	Professor
Name	Ian Jacobs
Position	Chief Executive Officer (Vice-Chancellor)
Signature	

APPENDIX

Calculating the effectiveness of university widening participation activities on the academic attainment of rural Australian students

This article details the effect university widening participation activities have had in raising the academic attainment of students from rural secondary schools, specifically, rural government schools in New South Wales, Australia. The authors have employed a mixed methods approach utilising quantitative statistical modelling combined with narrative analysis to determine widening participation effectiveness across a seven-year period from 2010 to 2016. Multilevel growth models were performed on school Australian Tertiary Admission Rank eligibility, application, offer and enrolment counts to quantify widening participation effectiveness. Statistical results were corroborated, refuted and further explored with interview data collected from teachers and careers advisors at thirty-five government schools across rural New South Wales. Multilevel models suggest widening participation programs that aimed to boost parental and community involvement and support in students' high school achievement were a significant predictor of attainment rates between 2010 and 2016. However, academic attainment was found to have remained static for the study period. A disconnect between empirical quantitative evidence and teacher testimony was uncovered.

Participation rates at university vary geographically in Australia. Secondary school students in regional and remote (herein referred to as rural) areas of the country have historically accessed university at lower rates than secondary students from metropolitan areas (DET 2016). A geographic location trend in university access has been linked to an academic achievement/attainment gap (cf. Reardon 2011 and Haile and Nguyen 2008 respectively) that exists in western education systems (Atkin 2003), including Australia, and extends to other equity groups synonymous with rural locales (James et al 1999) and rural identities (Rubin et al. 2014). In Australia, university widening participation (also referred to as outreach) programs have been established over the last 30 years to lessen the gap between certain groups in society by providing outreach and education to sections of society on the disadvantaged side of the achievement gap (DEET 1990; Gale and Parker 2013; ACIL Allen Consulting 2017). Widening participation activities employed in rural settings offer manifold challenges in the Australian context that are very different or non-existent in other contexts/countries (Osborne 2003; Bossu et al. 2012). The programs and methods universities employ to widen participation vary greatly in many regards and the methods used to evaluate their success can be just as varied and fraught, as this article will explore.

The first section of this article outlines the rise and function of university widening participation and outreach activities in Australia followed by a review of published methods used to assess how effective these activities are. We describe the complexities around evaluating widening participation effectiveness and present the methods used in the current study, which is followed by a description of results. The last section of the article provides a discussion of the research and an analysis of results and their significance.

Widening participation in Australian higher education

The active role of Australian universities in addressing societal equality was established in 1990 when the Australian government placed responsibility on universities to institute the

equal representation of non-traditional groups in higher education (DEET 1990). However, university contribution to outreach did not burgeon until nearly twenty years later following a government report by Bradley et al. (2008) that helped highlight the social and economic benefits of an educated society and the feeling that social inclusion is a core responsibility for all publicly funded institutions (Bradley 2008; Gale and Tranter 2011), subsequently leading to questions over the need for all to be university educated (Kemp and Norton 2014; Adnett 2016). Outreach was entrenched when the Higher Education Participation and Partnerships Program (HEPPP) was initiated by the federal Department of Education and Training to provide a monetary incentive and allocate funds to universities in their pursuit of widening participation. Many universities have since tried to boost their equity cohort numbers by employing access schemes that provide concessions for students identified as disadvantaged, with varying efficacy (Walton and Carrillo 2017).

A recent evaluation of the HEPPP has highlighted some gains since its inception and proposed its ongoing operation in the search for educational equity while providing recommendations for continued improvement (ACIL Allen Consulting 2017). One of the outcomes of the HEPPP evaluation was a recommendation for “a greater focus on more rigorous evaluative research that can help identify the most effective approaches” to widen participation (ACIL Allen Consulting 2017 xix). In addition, the review has called for research that “will allow for stronger conclusions to be drawn on causal impacts” implying that previous efforts to analyse the effectiveness of outreach activities have often lacked “rigorous evaluative research” (ACIL Allen Consulting 2017 xix).

Efforts to evaluate university widening participation activities

Webb et al. (2017) noticed that widening participation as a field of research in Australia values utility over critical theory and its productivity has subsequently suffered from a separation of theory and practice. Moreover, the nebulous identity of widening participation activities in Australia combined with a promise of government funding regardless of proven outcomes has contributed to a culture of outreach performance that can often lack the aforementioned “rigorous evaluative research” necessary to advance program performance (ACIL Allen Consulting 2017 xix). Holland et al. (2017) state that evaluating widening participation without knowledge of evaluative or investigative research methods is a barrier to rigorous research performance.

Attempts by equity researchers/practitioners to inform their peers of how to evaluate widening participation activities in the form of brief introductory-style documents (CSHE 2010; Wilkins and de Vries 2014; Naylor 2015) shows evidence of a sector shoehorned into performing evaluative research. The inability of previous attempts to strengthen widening participation evaluation in Australian higher education was noted by Naylor et al. (2013 p7) who cite a “relative dearth of publicly available, peer-reviewed research or evaluation, conducted with rigorous methodologies, on the effects of equity initiatives” – a sentiment echoed more recently in the HEPPP evaluation report (ACIL Allen Consulting 2017). Moreover, the scale of widening participation evaluation is often limited to individual university programs or activities within programs, where isolating the effectiveness of a single program or activity is easily conflated with the influence of other variables (Fink 2015; Naylor 2015; Reed et al. 2015).

Prelude to methodology: addressing issues and complexities in widening participation effectiveness evaluations

There are several reasons that quantifying the effectiveness of widening participation activities can be challenging, in Australia and internationally. Defining equity groups, and subsequent specified impact, can be complex due to inaccuracy in identification (Rubin et al. 2014), the likelihood of membership in multiple equity groups (Naylor et al. 2016) and the possible betrayal of ontological claims by inappropriately designating equity group status on an individual (Dei 2008; Rubin et al. 2014). There is also debate around the usefulness of effectiveness evaluation in the face of potentially undermining successful activities (Harrison and Waller 2017). The context or definition of program success can also muddy conclusions, attenuating the significance of results and their applicability to other studies while challenging widening participation epistemology (Crawford 2014; Adnett 2016). These issues are amplified when evaluators are rushed or not equipped to perform thorough investigations (Holland et al. 2017).

Several authors maintain that a major obstacle to quantifying the success of widening participation activities results from difficulties locating causal relationships between intervention and outcome, and the interweaving of program effects (Price et al. 2010; Gale and Parker 2013; Naylor et al. 2013; Harrison and Waller 2017; Holland et al. 2017). However, published studies that have adopted the use of robust statistical methods have shown that causality can be inferred under certain circumstances. An example of nuanced statistical enquiry in this vein is offered by Chowdry et al. (2012) who use linked administrative data to better understand determinants of higher education participation of low socioeconomic background students in England. Data sourced by Chowdry et al. (2012) provided a census of state school children where academic achievement scores and various demographic variables – such as age, home address, ethnicity and markers of disadvantage such as socioeconomic status – were leveraged in a two-level nested linear model to quantify group differences in participation rates. Chowdry et al. (2012) were able to employ a fixed effect multilevel model thanks to their possession of population-level data, which limited unobserved data and was able to produce estimates (statistically) close to reality.

Multilevel modelling

Multilevel models (also known as hierarchical linear models) are a statistical technique that considers the nested nature of social data, such as students in rural schools being more related to each other than students in metro schools, and permits models to be run when these data are non-independent, unlike ordinary least squares regression analyses (Raudenbush and Bryk 2002; Twisk 2006; Garson 2013). Studies that attempt to estimate effects of student- and school-level variables in a single model, either by including school-level variables in a student-level model or by incorporating aggregated values of student-level variables in a school-level model, can produce faulty results (Rumberger 1995; Raudenbush and Bryk 2002; Twisk 2006; Walton 2016). Bell et al. (2013 p1) state that “research has shown that ignoring a level of nesting in data can impact estimated variances and the available power to detect treatment or covariate effects”, whereas multilevel models, which were in fact created specifically for use in educational data analysis (cf. Raudenbush and Bryk 2002), are recognised as ideal for estimating unique associations of student- and school-level variables on academic attainment (McConney and Perry 2010; Walton 2016). There are several instances of investigators applying multilevel modelling in

educational research to infer causal treatment effects on student (and teacher) achievement over time (for example Hong and Raudenbush 2008; Raudenbush 2009; Maerten-Rivera 2013).

Mixed methods

A multilevel model is a powerful statistical technique, but it cannot wholly account for why people feel or act in the ways they do or qualify the lived experience of the embodied subject (Walton 2016). McConney and Perry (2010 p439) caution that:

“[Multilevel models] rely on often unspoken assumptions that relationships among variables under study are linear. The approach can thereby result in the unintended consequence that departures from linearity in relationships for particular subgroups of students within the dataset, which may become evident with a finer grained analysis, are masked.”

Drawing from big data can better facilitate investigations on a scale larger than a single program or a single institution and can be bolstered by engaging a mixed methodology. For instance, from Australia, KPMG (2015) recently undertook an independent evaluation of widening participation effectiveness that engaged multiple data sources and methods of analysis in a multi-institutional investigation. External evaluation such as this can combat what Sellar et al. (2010 p26) cite as “shortcomings in independence and design [that] call into question the validity and reliability of most program evaluations”. The KPMG (2015) report showed that an evaluation of university widening participation activities in Australia across multiple institutions and over multiple years is achievable using big data in a mixed methods approach. The outcomes of the KPMG (2015) report, and the methods used therein to evaluate multi-institutional widening participation initiatives, could however be further bolstered by investing in a more detailed statistical approach – something yet to be achieved in Australia’s unique widening participation context.

Forrest et al. (2017 p18) caution that “any study of a large region like country [rural] New South Wales implies a need to include a geographical perspective”. Rurality has been recognised as requiring special attention in the Australian education context (Forrest et al. 2017), which is distinctly different to, for instance, the UK context (Forrest and Dunn 2013; Webb et al. 2017). The impact of university outreach in rural Australia has not yet received an investigation that considers its unique geographic context within a mixed method design that marries expert testimony with a robust statistical examination. With this in mind, and considering the methodological examples mentioned thus far, their lessons and opportunities, the authors have employed a mixed method design within the interdisciplinary and integrative purview of geographic and social science to evaluate the effectiveness of university-run widening participation intervention in rural New South Wales, Australia.

Methodology

A mixed method sequential design that includes quantitative statistical modelling supported by qualitative narrative analysis was engaged to calculate the influence of university-run widening participation programs on rural schools. Government operated schools in New South Wales (NSW), Australia classified by the Australian Statistical Geography Standard (ASGS) as non-metropolitan were targeted in the investigation (cf.

<https://data.cese.nsw.gov.au/data/dataset/nsw-public-schools-master-dataset>: accessed 16

December 2017) across a seven year period. Methods of data acquisition and analysis are detailed in the following sections.

A mixed method sequential design that includes quantitative statistical modelling supported by qualitative narrative analysis was engaged to calculate the influence of university-run widening participation programs on rural schools. Government operated schools in New South Wales (NSW), Australia classified by the Australian Statistical Geography Standard (ASGS) as non-metropolitan were targeted in the investigation (cf. <https://data.cese.nsw.gov.au/data/dataset/nsw-public-schools-master-dataset>: accessed 16 December 2017) across a seven year period. Methods of data acquisition and analysis are detailed in the following sections.

Data and variable acquisition for statistical modelling

A unique data set was constructed to carry out the investigation. The study considered the 190 government-run rural NSW secondary and central schools not classified as special needs schools¹. Success indicators, which served as dependent variables in statistical modelling, were sourced from the Universities Admissions Centre (UAC). Success indicators (or outcomes) were requested for the period of 2010 to 2016 – data collected prior to these seven years were progressively less complete and unreliable. Four outcomes to value the influence of widening participation were identified:

1. ATAR-eligible count for each rural NSW school²;
2. Applications to university from each rural NSW school;
3. Offers from NSW universities made to each rural NSW school;
4. Enrolments in NSW university undergraduate courses from each rural NSW school.

Data collected from UAC permitted the longitudinal study of student progression to university (enrolments), attempted progression to university (applications and offers) and university eligibility (ATAR-eligible) in an analytic investigation of linked administrative data. Previous research has outlined that several factors can influence student progression, and intent for progression, to university (Carrillo et al. in press). Time variant and invariant predictors previously identified as likely contributors to university progression, particularly for schools and communities in Australia's rural settings (James et al 1999; Bradley et al. 2008; Parker et al. 2016), were appraised in statistical modelling at school level and at the geographic locale/town level. The demographic make-up of the 190 schools included in the study, as well as the predictor variables considered in analyses, is displayed in Table 1. Predictor data were sourced from the Australian Curriculum, Assessment and Reporting Authority by request and through UNSW's Student Information System.

¹ Secondary schools enrol students from year 7 to year 12. Central schools enrol students from kindergarten to year 12. Central schools tend to operate in smaller rural towns.

² The Australian Tertiary Admission Rank (ATAR) is received by students who sit their secondary schooling final examinations and is based on their results in these examinations. The ATAR represents the primary criterion for entry in undergraduate university programs in Australia.

Appendix Table 1: Sample demographics categorised by predictor types.

		n	MEAN	MEDIAN	RANGE
SCHOOL LEVEL PREDICTORS					
School type	Central	62	-	-	-
	Secondary	128	-	-	-
Year 12 population		-	49.93	41	0 - 246
School population		-	447.72	398	18 - 1550
ATSI population ³		-	18.22	12	1 - 100
ICSEA score ⁴		-	921.17	939	580 - 1156
EAS designation ⁵	SO1E	152	-	-	-
	SO1C or SO1R	36	-	-	-
LOCALE-LEVEL PREDICTORS					
Town population ⁶		-	10630.4	3584	178 – 70000
Nearest university campus (kms)		-	160.05	115	0.5 – 1428
ASGS rurality classification	Inner Regional	94	-	-	-
	Outer Regional	76	-	-	-
	Remote	12	-	-	-
	Very Remote	8	-	-	-

Calculating outreach program impact

The final predictor in analyses was the impact of university widening participation programs on outcomes. A quantified rating of widening participation impact from 2010 to 2016 for each school was required to fit into a statistical model. This was achieved by first creating a matrix of outreach activity in survey form in Microsoft Excel and requesting senior widening participation practitioners at the 11 universities operating in NSW with major campuses to complete it, with eight fully cooperating⁷. The matrix contained a list of common/generalised themes and subthemes customarily addressed by widening participation schools outreach activities (derived from Gale et al. 2010 and Naylor et al. 2013, as well as from expert advice from senior outreach practitioners at the authors' institution). Practitioners were asked to indicate on the matrix what themes their outreach

³ Students who identify as Aboriginal or Torres Strait Islander (ATSI).

⁴ An Index of Community Socio-Educational Advantage (ICSEA) score is given to a school based on the level of educational (dis)advantage of the school's population relative to other schools.

⁵ The EAS is a federal government operated mechanism to identify levels of school disadvantage. Schools can be assigned one of three types of EAS disadvantage: the first is based on state government identification of school disadvantage (SO1E) and the others are awarded due to having a rural locale (SO1C or SO1R). EAS designation was taken for the year 2016. Note: there were two schools in our sample that did not classify in any disadvantage category according to the EAS.

⁶ Town population was taken from the 2016 Australian census.

⁷ University activity surveys for non-response universities were completed in-house with limited data shared by those institutions and by referencing public data available on the internet.

group addressed for each school and the contact frequency each year (from 2010 to 2016) that a theme was addressed. Themes and their subthemes can be seen in Table 2.

Appendix Table 2: Themes and subthemes customarily addressed by university widening participation schools outreach activities and programs. Italicised words represent variable name in modelling.

THEMES	SUBTHEMES
Inform aspirations for higher education (<i>Inform</i>)	<ul style="list-style-type: none"> • Improve study skills and/or assist subject choices (<i>studyskills</i>) • Boost parental and/or community involvement and support (<i>parents</i>) • Increase teacher support for aspirations (including professional development and curriculum enhancement) (<i>teacher</i>)
Pre-entry university experience programs (<i>Experience</i>)	<ul style="list-style-type: none"> • In-school or provincial workshops/events (to inform/familiarise academic and social expectations and strategies at university to build confidence and motivation) (<i>inschool</i>) • On-campus visits (include all visits to a university campus) (<i>campus</i>)
Admissions and access (not including recruitment) (<i>Access</i>)	<ul style="list-style-type: none"> • Pathways and entry information sessions (<i>entryinfo</i>) • University costs, financial and scholarship information (<i>finance</i>)

Several outreach practitioners were further asked to complete an outreach impact survey. The impact survey required practitioners to rank the positive impact of engagement (sub)themes in the outreach survey (impact defined as providing motivation to consider university enrolment) on a one to five Likert scale – with five indicating the (sub)theme has high impact. Impact survey scores from the five practitioners who participated were aggregated to create a final impact scoresheet (Table 3). The impact scoresheet was applied to the activity surveys and a total outreach ‘impact score’ that could be used as a covariate in modelling was created for all 190 schools for each year.

Outreach contact and impact over the study period are shown in Table 4 illustrating heightened number of schools contacted and subsequent impact occurring from 2010 to 2014 before beginning to decrease. Most universities admitted having little to no outreach activities prior to 2010. The next section describes how impact score and the other predictors were modelled in statistical analyses.

Appendix Table 3: Impact scoresheet showing aggregated practitioner impact ratings.

THEMES	SUBTHEMES	Year levels engaged	Contact frequency				
			1	2-3	4+		
Inform aspirations for higher education	Improve study skills and/or assist subject choices	4	1.0	1.0	1.0		
		5	1.0	1.0	1.0		
		6	1.0	1.0	1.0		
		7	1.0	1.2	1.2		
		8	2.0	2.8	2.8		
		9	2.2	3.4	3.4		
		10	2.4	4.0	4.0		
		11	2.0	3.4	3.8		
		12	1.8	2.8	3.4		
		Boost parental and/or community involvement and support	4	1.4	1.0	1.8	
			5	1.4	1.0	1.8	
			6	1.4	1.2	1.8	
	7		1.4	1.4	1.8		
	8		1.4	1.4	1.8		
	9		1.8	1.4	2.0		
	10		1.8	2.0	2.2		
	11		1.8	2.4	2.2		
	12		1.8	2.4	2.4		
	Increase teacher support for aspirations (including professional development and curriculum enhancement)		4	1.0	1.2	1.4	
			5	1.0	1.2	1.4	
			6	1.6	2.0	2.2	
		7	1.2	1.2	1.8		
		8	1.2	1.4	1.8		
		9	1.2	1.4	2.2		
		10	2.0	2.4	3.2		
		11	1.8	1.8	2.4		
		12	2.0	2.4	3.4		
		Pre-entry university experience programs	In-school or provincial workshops/events (inform/familiarise academic and social expectations and strategies at university to build confidence and motivation)	4	1.2	1.2	1.2
				5	1.2	1.4	1.2
				6	2.0	1.4	1.6
	7			1.4	1.8	1.6	
	8			1.8	2.2	1.8	
	9			1.8	2.0	2.0	
	10			1.8	3.2	2.2	
	11			2.0	3.6	2.8	
	12			3.2	2.8	3.0	
On-campus visits (include all visit to university campus)	4			1.2	1.2	1.6	
	5			1.4	1.2	1.6	
	6			2.2	1.4	1.8	
	7		1.8	1.8	2.0		
	8		2.2	2.0	2.2		

THEMES	SUBTHEMES	Year levels engaged	Contact frequency			
			1	2-3	4+	
		9	2.0	2.4	2.8	
		10	2.6	2.8	3.0	
		11	2.6	2.4	2.4	
		12	2.6	2.4	2.4	
Admissions and access (not incl. marketing/recruitment)	Pathways and entry information sessions	4	1.0	1.0	1.0	
		5	1.0	1.0	1.2	
		6	1.2	1.2	1.2	
		7	1.4	1.2	1.4	
		8	1.8	1.4	1.4	
		9	2.0	1.8	1.8	
		10	2.6	2.0	2.4	
		11	3.0	2.2	3.0	
		12	3.0	2.2	3.2	
		University costs, financial and scholarship information	4	1.0	1.0	1.0
			5	1.0	1.0	1.0
			6	1.2	1.0	1.2
	7		1.4	1.4	1.4	
	8		1.8	1.4	1.4	
	9		2.0	1.8	2.0	
	10		3.0	2.4	2.6	
	11		3.2	2.4	2.8	
	12		3.2	2.6	3.4	

Appendix Table 4: The number of NSW rural schools receiving outreach per year and associated impact score.

YEAR	SCHOOLS IN OUTREACH	TOTAL OUTREACH IMPACT SCORE
2010	78	1157.0
2011	91	1473.2
2012	146	4202.4
2013	150	5278.0
2014	168	9020.2
2015	160	7547.8
2016	160	7205.2

Statistical modelling of quantitative data

Several considerations contributed to what statistical model was run on the study dataset. First, dependence in the data was evidenced by measuring intraclass correlation. The continuous nature of the dependent variables dictated a general linear model to assess changes within schools and school clusters while non-independent data restricted

regression use. Having repeated-measures of dependent variables at distinct years meant a three-level multilevel growth model fit the data in that measuring multiple changes for distinct schools required a three-level structure – impact scores across time (level-1) nested within individual schools (level-2) nested within school rurality (level-3). As mentioned, rurality has been recognised as requiring special attention in the Australian context (Forrest et al. 2017), which is distinctly different to, for instance, the UK context (Forrest and Dunn 2013; Webb et al. 2017). The vastness of the Australian landscape, its unique education geography, arguably permits use of location as a variable of significant consequence that would otherwise be less applicable in analyses of other western education contexts.

Tasca et al. (2009 p456) describe how

“three-level nested growth MLMs address the longitudinal design research questions, such as what is the group rate of change, what is the shape of this change, and was there an effect of treatment conditions or other predictors on group rate or shape of change?”

A substantial sample size is beneficial to successfully operating a multilevel model, particularly at the second level (Tasca et al. 2009). Maas and Hox (2005) suggest a sample size over 50 at level two. The level-2 variable in the current study is 190 (schools). There is scant published research on level-3 sample sizes, although, Ferron et al. (2009) illustrate that a Kenward-Roger estimation method can account for smaller sizes (the current study has four rurality classifications at level-3).

The basic multilevel model equation incorporating a three-level structure denotes a random intercept that distinguishes it from a standard hierarchical regression equation (Appendix 2). The structure of this equation allows changes over time and school to be assessed within the context of school rurality. Identified differences in the change of growth meant a random quadratic time effect was also input into the model as a level-1 predictor. Variability in the dependent variables across schools and years denote a random slope and intercept model, and a lack of population data supported not relying on a fixed effects approach.

Models were built in SAS Enterprise Guide 7.1 (SAS EG) using the PROC MIXED function (Bell et al. 2013). SAS EG’s ability to perform multilevel growth modelling and run large datasets and then combine and filter them down, including restructuring data through wide and long formats, was particularly salient for the requirements of this research. The PROC MIXED code was input in multiple iterations with outputs recorded at each stage⁸. Different covariance structures were applied to find the best model. Statistical results were later compared against the qualitative evidence from interviews.

Interview performance and analysis

The purpose of the interview is to explore and understand actions within a specific setting (the impact of widening participation efforts on academic attainment in rural NSW), to examine human and environmental relationships and unpack why people feel or act in the ways they do (McDowell, 2010). Walton (2016 p43) explains that longitudinal data does not

⁸ The literature on MLMs recommends they be built in stages, with variables and effects added to each stage (Garson 2013). Output from the statistical software can inform the analyst whether the latest model is a better fit than the last. The overall fit of a model is tested using a chi-square likelihood ratio – the *-2LL* (negative two log-likelihood) or *deviance*. The smaller the value, the better the model fit.

cover the required narrative to thoroughly enfold “the discourse surrounding interaction and success” in educational research. Therefore, narrative analyses contribute to the conclusions offered in this article.

Thirty-five semi-structured in-depth interviews (and eight pilot interviews), lasting an average time of about 30 minutes, were performed to supplement the quantitative data. Interviews were targeted at careers teachers because they were assumed, on average, to have had the most contact with university outreach. Interviews were performed in-person at 35 rural central and secondary schools. The authors spent four weeks driving to schools in a round trip of 4686 kilometres, covering a 124,354 square kilometre area of rural NSW – approximately one seventh the size of the state of NSW, or, the size of England. Interview questions were centred on the presence and impact of university-run widening participation efforts within schools. The demographic make-up of interview participants was 63% female and 37% male, while 51% were employed at a high school and 49% at a central school. Length of employment for teachers at each school ranged between two and 28 years at a mean of 12.6 years.

Interviews were recorded then coded for themes using NVivo software, which facilitated the retrieval of unsystematised text material into a structured format for analysis. The qualitative methods of narrative analysis (Minichiello 2008) were used to decode discourses pervading statistical evidence, as well as establish new findings. The final sections of this article report then discuss results from the synthesis of quantitative and qualitative data analyses.

Results

Multilevel growth models were performed to infer changes in the four dependent variables (ATAR eligible, applications, offers and enrolments) in schools from 2010 to 2016 while considering the predictive value of independent variables, specifically, the predictive value of impact score. In addition, the themes and subthemes of the impact score (listed in Table 2) were tested for their discrete influence on outcomes within the model. A summarised list of statistical results is presented in Table 5, highlighting the distinct influence of fixed-effect predictors on outcomes.

The level-1 intercept was non-significant for all outcomes, which indicates that there was no significant change in the amount of ATAR eligible students, or number of offers, applications or enrolments between 2010 and 2016. Significant variation detected in random slopes and intercepts suggests that outcomes are dependent on school and school rurality. Significant predictors for all four outcomes were found for EAS designation, school type, school population and year 12 cohort size, as shown in Table 5. Impact scores were at large found to have no effect on outcomes, with the exception being programs to ‘boost parental and/or community involvement and support’, which indicated a significant positive influence on the number of applications ($p < 0.05$), offers ($p < 0.05$) and enrolments ($p < 0.01$) in the seven-year period of study.

Appendix Table 5: Fixed effect estimates with standard errors in parentheses for final iteration of multilevel growth models.

		OUTCOMES			
		ATAR ELIGIBLE	APPLICATIONS	OFFERS	ENROLMENTS
Predictors	Year	-0.61(2.85)	0.14(1.51)	0.49(1.58)	-0.29(0.61)
	Year ²	-0.21(0.17)	-0.32*(0.13)	-0.27*(0.12)	-0.04(0.08)
	Town_pop	<0.01(<0.01)	<0.01(<0.01)	<0.01(<0.01)	<-0.01(<0.01)
	Near_campus	<0.01(0.01)	<-0.01(0.01)	<-0.01(0.01)	0.01*(0.01)
	EAS	6.76*(3.16)	4.67**(1.61)	4.37*(1.91)	1.88*(0.76)
	Sch_type	8.77**(2.68)	4.69**(1.79)	4.16*(1.67)	2.44**(0.65)
	Sch_pop	0.02**(<0.01)	0.02**(<0.01)	0.01**(<0.01)	0.01**(<0.01)
	ICSEA	0.04*(0.02)	0.03*(0.01)	0.02(0.01)	0.01*(0.01)
	Yr_12_cohort	0.09** (0.02)	0.06** (0.02)	0.06** (0.01)	0.02** (0.01)
	ATSI_pop	0.04(0.03)	0.03(0.03)	0.02(0.02)	0.01(0.02)
Impact score	Total_Impact	0.01(0.02)	0.01(0.02)	0.01(0.02)	<0.01(0.01)
	Inform	0.05(0.06)	0.03(0.05)	0.04(0.04)	0.03(0.02)
	Experience	0.02(0.06)	0.01(0.05)	<0.01(0.04)	<-0.01(0.02)
	Access	-0.04(0.06)	-0.01(0.05)	-0.02(0.04)	-0.01(0.02)
	studyskills	0.08(0.09)	0.03(0.08)	0.05(0.6)	0.04(0.04)
	parents	0.24(0.33)	0.53*(0.27)	0.48*(0.22)	0.35** (0.12)
	teacher	0.11(0.14)	0.04(0.13)	0.1(0.09)	0.06(0.06)
	inschool	0.05(0.09)	0.06(0.07)	0.04(0.06)	<0.01(0.04)
	campus	<0.01(0.12)	-0.07(0.1)	-0.06(0.09)	-0.02(0.04)
	entryinfo	-0.03(0.12)	0.02(0.11)	0.02(0.08)	<0.01(0.05)
	finance	-0.11(0.11)	0.02(0.11)	-0.07(0.07)	-0.04(0.04)
Model	School ICC	0.31	0.25	0.29	0.48
	Rurality ICC	0.1	0.11	0.12	0.2
	Variance Structures	autoregressive	autoregressive	autoregressive	autoregressive
	Deviance	10995	10177.8	9972.1	8443.3

Values based on SAS PROC MIXED; Distinct analyses were run for each Impact score variable; Predictors and Deviance scores for Total_Impact model only; *p<.05 **p<.01; Estimation method = Kenward-Roger; All level-1 fixed intercepts were non-significant; All level-2 (School(Rurality)) and level-3 (Rurality) random effects varied significantly.

Discussion points

This study was performed to calculate the impact of university widening participation intervention in rural NSW government schools. This section discusses the results of the current investigation and their consequence for future work.

Results from statistical modelling performed for the current investigation contrast somewhat with most other recent Australian university rural widening participation program evaluations that have tended to describe self-reported or impromptu observational changes in attitude rather than changes in quantified attainment (for example KPMG 2015; Johns et al 2016; Fleming and Grace 2017). Results from these studies contrast

with Parker et al. (2016), and statistical results from the current study were similarly found to conflict with many of the beliefs and opinions of teachers captured during in-depth interviewing. Divergent results found within the current research are explicated throughout the following subsections.

Opposing quantitative and qualitative ‘evidence’

The majority of teachers had positive opinions about university widening participation programs in their schools. Thirty-four out of thirty-five teachers believed their school needed university-promoting programs citing reasons such as helping teachers to help students: *‘Teachers need to understand what universities are requiring’* (Interview 1); exposing students burdened by distance to university experiences: *‘kids here feel quite distant from tertiary education because they don’t see it in their day to day lives...these [widening participation] programs help fill that gap’* (Interview 11); or to broaden students’ knowledge of their post-school options: *‘[students] don’t always have a broad enough knowledge [of what post-school options are available] like different job prospects or what’s on offer at university. The more that we can expose them [to post-school options] the better’* (Interview 7). Teachers were also asked how university widening participation activities had impacted their schools. Again, most responses were positive. Teachers gave different explanations as to how widening participation programs had positively impacted their students, for example one teacher cited their influence on student aspirations: *‘it helps them see that there’s more out there and that there’s different options. I think they (university widening participation programs) are very successful in helping [students to] contemplate uni’* (Interview 10), while another teacher saw value in their ability to address issues of isolation from university due to location: *‘going to the [university] open day there were some students who hadn’t really thought that going to uni would be something they could do because of how far away the unis are, [afterwards] they thought they could do anything and that it (going to university) is possible’* (Interview 28).

Distance from a university has been cited as a factor in student decisions to attend university education (Parker et al. 2016; Carrillo et al. in press), which is supported in the current study by statistical evidence (the Near_campus variable was found to have significant influence on school enrolment to university numbers ($p=0.02$)) and by teacher testimony: *“the further west you go there is a larger impact on just being connected with a university – the visual presentation of a campus is just not there”* (Interview 18); *“if there’s not a course at [a local regional university] or somewhere relatively close then uni might not become an option for [students]”* (Interview 2). Fifty-seven percent of interview participants cited physical distance to university as the biggest barrier to academic attainment at their school while physical distance or distance-related issues such as being separated from family, friends and community as well as finance issues were cited by eighty-nine percent of teachers as the biggest barriers. Teacher acknowledgment of the difficulties of distance corresponded with held beliefs about the potency of on-campus visits through widening participation activities, for instance, *‘[university] visits help students who are fearful or don’t know much about uni to bridge the problem’* (Interview 11). Table 6. Illustrates what teachers thought to be the best way to motivate students to go to university.

Appendix Table 6: Interview participant’s beliefs about the best way to motivate rural students to go to university.

BEST WAY TO ENCOURAGE UNIVERSITY PARTICIPATION	FREQUENCY
Financial assistance	10
Campus visit	7
Role models	6
General engagement with universities	6
Familial or community support	3
Have a campus in town	3

One teacher explained *‘I could talk all day and the kids would just hear this and that, but when you go there (to a university) and you see it (the university) that’s very different’* (Interview 14), while another expands *‘you’re removing that factor of it being unknown’* (Interview 34). However, statistical modelling showed on-campus visits had no statistically significant influence on academic attainment numbers (Table 5.) (and nor did widening participation programs providing information on university costs, scholarships and financial advice, considering these were suggested by teachers as the best information students could get to encourage them to go to university).

Table 6. shows that only three teachers thought having familial or community support was the best source of student motivation for university attainment. This is not to say teachers did not think familial and community support was unimportant, rather it tended to be overlooked as the most important contributor to academic attainment. In contrast, multilevel modelling suggests academic attainment figures were significantly influenced by widening participation activities that target the increased support of students’ families and communities (Applications $p=0.03$, Offers $p=0.04$, Enrolments $p<0.01$). Daniel (2015 p119) declares “parent involvement has been widely acknowledged as promoting children’s educational development and outcomes”, while Roberts (2015 p132) asserts that rural students’ underperformance in academic outcomes can be attributed to “a lack of social and cultural facilities in the local community”. Boosting parental and community support was the only widening participation theme found to have a statistically significant influence on academic attainment. This result would be near impossible to predict if conclusions were drawn solely from teacher testimony.

Exploring the disconnect between teacher beliefs and statistical outcomes

Notwithstanding overwhelmingly positive feelings about university widening participation programs, teachers were not as convinced about the ability of university programs to improve student attitudes about going to university or affect students’ behaviours towards a goal of university attainment. Teachers were asked if they had noticed any difference in attitudes before compared to after students had engaged with widening participation programs and most teachers noticed a positive change, for example, *‘you can see it helps them’* (Interview 12), *‘some kids at least have more of a think about uni’* (Interview 24) and *‘it just invigorates their outlook on life ... all of a sudden they start to think something different [such as going to university] is possible’* (Interview 7). However, the positive attitude changes brought on by widening participation interactions were sometimes described as fleeting: *‘for a short period of time [attitudes improve], it’s not like ‘oh my god*

my life's changed, but for a short period of time [their attitudes improve]" (Interview 7), '[the students are] initially excited but then they drop off very quickly' (Interview 12), 'I couldn't say it (positive attitudes towards university) has lingered. No, I couldn't say that' (Interview 24). Some teachers were ambivalent about the ability of university widening participation efforts to shift behaviours towards a university goal. One teacher believed widening participation programs were more helpful for students already intending to go to university: 'It was, I guess, encouragement for those who were already on the radar with those possibilities' (Interview 13). Another teacher noticed behaviour changes away from university: 'you get that group of kids who just freak out and think 'I can't get those marks' and they [consider options] elsewhere' (Interview 31), which can also be considered a positive behavioural change (Adnett 2016; Daniel and Johnstone 2017). The following quote by a teacher illustrates recognition of the difficulty in attributing university intervention to behavioural change, they explain:

'It's hard to quantify [behavioural change] but I've seen students, and whether it's just maturity or whether it's them attending the [widening participation program] days, I've noticed students in a better head space and look like they're more settled at school. But it's hard to know whether it's [the influence of university programs] or it's a combination of things' (Interview 2).

Conclusions

The investigation underpinning the writing of this article involved a mixed methods approach to evaluate the effectiveness of university widening participation activities on government schools in rural NSW, Australia. Multilevel modelling revealed widening participation activities that aim to 'boost parental and/or community involvement and support' were a significant predictor of the number of university applications, offers and enrolments from rural NSW government schools between 2010 and 2016. No other outreach activity, nor combined activities, had a positive influence on attainment numbers.

This study was limited to the effect of outreach in rural NSW government schools from 2010 to 2016. The size of the study area was restrictive on in-situ interviewing methods making a broader coverage of teacher testimony resource intensive beyond the capabilities of funding. These issues are particularly prevalent in samples delimited by Australia's geographic vastness (Forrest et al. 2017). Future studies might consider variables not obtained for the current research to buff out conclusions. Other variables to consider in statistical modelling might include the impact of early or special enrolment offers as well as other marketing and recruitment techniques that could influence attainment numbers. The influence of nearby TAFE and the opportunities in local labour markets could also be considered influential to certain communities, schools or students. Notwithstanding the omission of these predictors and their potential statistical influence, the authors believe a significant consideration of variables to make casual inference was accomplished consistent with previous studies (cf. Raudenbush 2009; Chowdry et al. 2012; Maerten-Rivera 2013).

In-depth interviews brought to light teacher beliefs about university widening participation effectiveness that supported statistical findings regarding the positive influence of university intervention on student attainment. Teachers also saw benefits in engaging university widening participation programs that extended beyond academic attainment and included broadening students' experiences of life outside their town or community, experiences that

contribute to academic attainment. Teachers believed activities boosting parental and community support were important, but the level of importance tended to be superseded by widening participation activities that targeted other areas such as pathways to financial aid or visiting university campuses. The findings from this research could be extended to other geographic and national contexts, and the authors would endorse further exploration of the subject matter.

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