using student achievement data to identify school improvement and effectiveness over time

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South Australia
presentation

- context
- background
- data collection
- data structure
- research method
- results and discussion
- next step
context

• is not achievement it is improvement over time
• improvement is natural over time
• improvement varies over time
• improvement is influenced by a number of factors
background
• literacy and numeracy tests are administered annually to years 3, 5 & 7 students in DECS schools

• Rasch scaling is the basis of test construction and analysis

• years 3, 5 & 7 achievement is reported on a common scale
• student progress is the difference in their achievement scores between successive tests
- Hungi (1996) reported that literacy and numeracy are distinct traits and that it was appropriate to calculate scores for literacy and numeracy separately

- literacy and numeracy analyses in this study are presented separately
data collection
• data in this study collected from three cohorts:

• Cohort 1 did years 3, 5 and 7 tests in 1997, 1999 and 2001
• Cohort 2 did years 3, 5 and 7 tests in 1998, 2000 and 2002
• Cohort 3 did years 3, 5 and 7 tests in 1999, 2001 and 2003
• student's results matched across the tests on three occasions
<table>
<thead>
<tr>
<th>Cohort 1</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>School</th>
</tr>
</thead>
<tbody>
<tr>
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<td>3373</td>
<td>3180</td>
<td>6553</td>
<td>393</td>
</tr>
<tr>
<td>Cohort 2</td>
<td>3395</td>
<td>3294</td>
<td>6689</td>
<td>393</td>
</tr>
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data structure
• data are hierarchically structured: about 20000 students are nested in over 390 South Australian government schools
research method
• Meyer (1980), Willms and Raudenbush (1989) report that research on school effectiveness requires a multilevel formulation because outcomes can be affected by:

• different factors operating at different levels

• effects which can interact across levels
• the hierarchical linear model is a preferred model in school effectiveness research (Raudenbush and Willms, 1989; 1995)

• the three level hierarchical linear model (HLM) is the model used in this study

• HLM5 for Windows developed by Raudenbush, Bryk, Cheong and Congdon (2000) is the program used in this study
three level hierarchical linear model (HLM)

level 1
within student

- year levels
  - year 3
  - year 5
  - year 7
level 2 between students

- individual student background variables that do not change over time, such as Sex, ATSI and NESB

- individual student background variables aggregated over the three occasions, such as Age, Language spoken in the home, School cardholder, Years lived in Australia, and NEP
level 3
between schools

• school characteristics
likely variables at the within student level

- year 3
- year 5
- year 7

level 1

outcome variable

literacy
numeracy
likely variables at the between student level

- sex
- average age
- Aboriginality
- non-English speaking background
- average time English spoken in the home
- average years lived in Australia
- average NEP
- average School Card
- Cohort 1
- Cohort 2
- Cohort 3

level 1

outcome variable

level 2

literacy numeracy
likely variables at the between school level

- proportion of girls
- average age of students
- proportion of non-Aboriginal students
- proportion of non-English background students
- average number of students who speak English in the home
- average no of students born in Australia
- proportion of non-School Card holders
- proportion of non-NEP students
- location (metro/country)
- index of economic resources
- index of educational and occupational status
- index of isolation
- average number of students in school
- proportion of students who attend school

level 1

level 2

level 3

outcome variable

literacy
numeracy
results and discussion

- predictors of student progress
- interaction effects
- variance explained
- school improvement
  - comparison - year levels
  - comparison - cohorts
- school effectiveness
predictors of student improvement

- significant factors influencing student improvement at different levels are presented for literacy and numeracy separately
<table>
<thead>
<tr>
<th>Level</th>
<th>Predictors</th>
<th>Literacy</th>
<th>Numeracy</th>
</tr>
</thead>
</table>
| Level 1 (within student) | • Year 5  
• Year 7 | ✓ | ✓ |
| Level 2 (between student) | • sex  
• Age  
• Aboriginality  
• Language spoken in the home  
• School card holders  
• NEP  
• Cohort 2  
• Cohort 3 | girls ✓ boys ✓ | - + |
| Level 3 (between schools) | • Measure of educational & occupational status  
• Proportion of non-Aboriginality  
• Average age  
• Language spoken in the home  
• Proportion school cardholders | ✓ | ✓ | x |
• estimates from complete populations show that students are expected to improve by about \( \frac{1}{2} \) a logit per year

• the estimates of effects can be expressed in months as a fraction of the learning during a school year
• it should be noted that about 1/3 of each of the cohorts has been eliminated from these analyses because they have changed schools and matching problems.

• consequently the cohorts do better than would be expected for their original populations.
<table>
<thead>
<tr>
<th>predictors</th>
<th>improvement effects expressed as a fraction of a year of school learning</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>literacy</td>
</tr>
<tr>
<td><strong>Level 1</strong> (within student)</td>
<td></td>
</tr>
<tr>
<td>• Year 5</td>
<td>4 months</td>
</tr>
<tr>
<td>• Year 7</td>
<td>1 months</td>
</tr>
<tr>
<td><strong>Level 2</strong> (between student)</td>
<td></td>
</tr>
<tr>
<td>• sex</td>
<td>8 months</td>
</tr>
<tr>
<td>• Aboriginality</td>
<td>8 months</td>
</tr>
<tr>
<td>• school card holders</td>
<td>7 months</td>
</tr>
<tr>
<td>• NEP</td>
<td>3 years</td>
</tr>
<tr>
<td><strong>Level 3</strong> (between schools)</td>
<td></td>
</tr>
<tr>
<td>• proportion of non-Aboriginality</td>
<td>2 ½ years</td>
</tr>
</tbody>
</table>
interaction effects
important to include (Bidwell and Kasarda, 1980; Raudenbush and Bryk, 1990)

Pituch (1999) highlighted the misleading interpretation when interactions between student background and school level variables are ignored
the interaction effect identified for literacy is:
• sex (level 2 variable) & location (level 3 variable)

the interaction effect identified for numeracy is:
• school card (level 2 variable) & location (level 3 variable)
literacy interaction effect: sex (Level 2) with location (level 3)
estimation of variance explained
• 48.2 per cent of the total variance is explained
• at the student level 43.4 per cent of the total variance is explained
• at the school level 4.8 per cent of the total variance is explained
• at the student level 46.9 per cent of the available variance is explained
• at the school level 62.3 per cent of the variance available is explained
• 51.3 per cent of the total variance available is explained
• at student level 46.4 per cent of the total variance is explained
• at the school level 4.9 per cent of the total variance is explained
• at the student level 50.7 per cent of the available variance is explained
• at the school level 56.3 per cent of the available variance is explained
school improvement

- comparisons of year levels
- comparisons of cohorts
comparisons of year levels
• using the residual values from the three level HLM analyses, it is possible to estimate values for each cohort of students at each year level for each school.

• this shows where they started in year 3 and where they finished at year 7

• in primary schools student improve on average 0.5 logit every year.
comparison of literacy improvement of Cohorts 1, 2 and 3 students by year level for School A
comparison of literacy improvement of Cohorts 1, 2 and 3 students by year level for School A
comparison of literacy improvement of Cohorts 1, 2 and 3 students by year level for School A
comparison of numeracy improvement of Cohorts 1, 2 and 3 students by year level for School B
comparison of numeracy improvement of Cohorts 1, 2 and 3 students by year level for School B
comparison of numeracy improvement of Cohorts 1, 2 and 3 students by year level for School B
comparison of cohorts
• using the residual values from the three level HLM analyses, it is also possible to estimate values for each cohort of students in each school.

• after estimation the three cohorts of students are compared.

• the comparison shows whether the school is improving or not.
comparison of Literacy and Numeracy improvement of Cohorts 1, 2 and 3 students for School X
comparison of Literacy and Numeracy improvement of Cohorts 1, 2 and 3 students for School Y
comparison of Literacy and Numeracy improvement of Cohorts 1, 2 and 3 students for School V
comparison of Literacy and Numeracy improvement of Cohorts 1, 2 and 3 students for School Z
comparison of Literacy and Numeracy improvement of Cohorts 1, 2 and 3 students for School W
school effectiveness
by controlling for all significant variables and interaction effects operating at Level 2 and Level 3, the three level HLM analysis provides residuals

interpreted as an effect associated with each school (Goldstein, 1997)

this effect associated is referred to as a ‘value added’ effect (McPherson, 1992)

used to identify unusually effective or not effective schools (Goldstein, 1991; Pituch, 1999) & reasons for unusual performance
figures present ranking of schools

• effective schools: on average a year or more above the average level of performance of all schools in the State after allowance for significant factors and interaction effects over the seven years

• not effective schools: on average a year or more below the average level of performance of all schools in the State after allowance for significant factors and interaction effects over the seven years
NUMERACY

One year performance above average

Average performance

One year performance below average

Not effective Schools

Effective Schools

Scaled score

Schools
• the ranking of schools in literacy is noticeably different from that in numeracy

• correlation between the literacy and numeracy estimated scores is 0.64

• Pituch (1999) indicated some schools may perform relatively better on one outcome measure rather than the other
Next step

• working with schools to answer the following questions

• why are some schools improving?
• why are some schools not improving?
• why are some schools effective?
• why are some schools not effective?
thank you