Study of Dual-Language Immersion in the Portland Public Schools

Year 4 Briefing

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Outline

• Study Context and Motivation
• Empirical Strategy and Data
• Student Achievement Effects
• Mediators and Cost
• Principals’ and Teachers’ Perspectives
• Instructional Practice
• Summary
Dual-Language Immersion (DLI) Study is Product of a Research-Practice Partnership

- Among largest 2 districts in Pacific Northwest
- Has operated immersion programs for almost 30 years
- About ¼ of schools are part of a DLI cluster
- About 10% of students are enrolled in DLI

- Non-profit, expert on 2nd language learning and immersion programs around the globe
- Team includes two language researchers and Portland-area graduate students

- Non-profit, non-partisan research firm
- Team includes a policy researcher, two economists, and an applied linguist
Current Study Is Federally Funded

- 3-year research grant from the U.S. Department of Education
- Now in year 4 (no-cost extension year)
- We leverage immersion lottery to estimate causal impact of DLI on student achievement in reading, math, and science
- We also document program costs, principal and teacher perspectives, and instructional practice
Study Is Nationally Relevant as Number of Dual-Language Immersion Programs Grows

- DLI programs provide **core content instruction in two languages**, generally from kindergarten onward

- Number of public immersion schools appears to be growing; some estimate it at 1,000 to 2,000 nationally (Maxwell, 2012, Watanabe, 2011)

- Examples of recent expansion efforts include
  - Utah (118 schools as of 2014-15)
  - North Carolina (94 schools as of 2014-15)
  - New York City (175 programs, 93 added since 2012-13)
Link Between Bilingualism and Cognitive Advantages May Contribute to Public Demand

- Improved working memory
- Superior executive control (ability to choose among alternatives)
- Better selective attention

(Bialystok, 2001; Bialystok, Craik, and Luk, 2008)
Studies of Native English Speakers In Immersion Have Been Small or Non-Randomized

- Randomized studies have shown positive or neutral effects
  - In Canada, Lambert et al. (1973) found *positive effects* on English reading and math by grade 5
  - In the U.S., Barnett et al. (2007) found *no detriment* to English reading for preschoolers after 1 year

- Though randomized, the studies had key limitations
  - Samples of <150, and focused on single schools
  - Students not tracked beyond grade 5

- Non-randomized studies have shown positive immersion effects but did not thoroughly adjust for selection into programs *(Barik & Swain, 1978; Caldas & Boudreaux, 1999; Marian, Shook, & Schroeder, 2013; Padilla et al., 2013; Turnbull, Hart, & Lapkin, 2003)*
Studies of ELLs in Immersion Are Promising But Have Lacked Randomization

• U.S. Studies Have Focused on English Language Learners (ELLs) in Two-Way Immersion
  • Immersion students have outperformed ELLs in monolingual English classes or transitional bilingual programs (Thomas & Collier, 2003; Collier & Thomas, 2004; Lindholm-Leary & Block, 2010; Marian et al., 2013)

• But studies have not carefully attended to selection bias

• Two recent studies that attempted to control for selection found
  • Higher ELL reclassification rates to proficient by high school (Umansky & Reardon, 2014), and
  • Faster growth in English reading performance (Valentino & Reardon, 2015)
What Makes This Study Important

• Portland’s lottery system reduces selection bias to which most other studies are vulnerable

• Study incorporates 19 schools (10 ES, 5 MS, 4 HS)

• Breadth of Portland’s programs allows us to disaggregate estimates for:
  o Native speakers of English vs. other languages (including classroom “partner” language)
  o Two-way and one-way programs
  o Spanish vs. other languages (Mandarin, Japanese, Russian)

• Mixed-methods approach lets us examine implementation across the district
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Our Preferred Estimation Strategy Leverages the District’s Immersion Lottery

- Families apply to up to three schools in the spring before pre-K or kindergarten
- Slots are filled in the first round
- Our analysis compares students who won slots to those who did not
- Analytic comparisons are made within lottery year, target school, and preference category (e.g., inside or outside of neighborhood, native language, etc.)
We Employ Three Modeling Approaches to Put the Lottery Estimates in Context

All three focus on the 7 kindergarten cohorts of 2004-05 through 2010-11

**Inclusive** of non-randomized students and of non-lottery schools

**Causal estimates:**
*Apple-to-apples comparisons* of families who apply to same programs in same years

**Causal estimates adjusted** to reflect those who comply with their random-assignment status

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- **Full-Sample Generalized Least Squares (GLS)** (n=27,741)
  - DLI students vs. all other students, with demographic controls

- **Intent-to-Treat (ITT)** (n=1,625)
  - Students who won immersion lottery vs. those who did not

- **Instrumental Variables (IV)** (n=1,625)
  - Adjustment of lottery-based (ITT) estimates for noncompliance with assigned lottery status
We Focus on Academic Outcomes in English, and on Implementation

Outcomes

- *Achievement in Mathematics, English Language Arts, and Science* (Oregon Assessment of Knowledge and Skills [OAKS], gr. 3-8)

- Probability of *English Language Learner classification* in each year after kindergarten (based on English Language Proficiency Assessment [EPLA] scores, gr. 1-8), conditional on initial status

- We describe limited evidence on partner language proficiency where available (Spanish, Mandarin, Japanese)

Cost and Implementation

- We also document dual-language immersion *costs and instructional practices*
## Study Examines a Diverse Array of DLI Programs

<table>
<thead>
<tr>
<th>Program Type</th>
<th>Native Language of Students</th>
<th>% of Instruction in Partner Language</th>
<th>Language</th>
<th>Schools</th>
<th>Students in 2012-13 (and % of total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>90/10 Two-Way</td>
<td>≈ ½ English</td>
<td>90% in Grade K 80% in Grade 1 70% in Grade 2</td>
<td>Spanish</td>
<td>7 ES 3 MS 2 HS</td>
<td>1,644 (42.6%)</td>
</tr>
<tr>
<td>90/10 Two-Way (previously 70/30)</td>
<td>≈ ½ Partner Language</td>
<td>60% in Grade 3 50% in Grade 5 2 periods in MS 1-2 periods in HS</td>
<td>Russian</td>
<td>1 ES</td>
<td>193 (5.0%)</td>
</tr>
<tr>
<td>50/50 One-Way</td>
<td>Mostly English (no native speaker set-aside slots)</td>
<td>50% in Gr. K-5 2 periods in MS 1 period in HS</td>
<td>Spanish</td>
<td>1 ES 1 MS 1 HS</td>
<td>614 (16.0%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Japanese</td>
<td>1 ES 1 MS 1 HS</td>
<td>920 (23.8%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mandarin</td>
<td>1 ES 1 MS 1 HS</td>
<td>489 (12.7%)</td>
</tr>
</tbody>
</table>
Final Sample, After 2015 Merge with State Data

Attrition rate: 19.3%

Attrition rate: 13.0%

Enrollment

DLI Applicants (n=3,457)

Randomized (n=1,946)

Non-binding lottery (n=1,511)

Assignment

Assigned to DLI (n=864)

Not assigned to DLI (n=1082)

Intent-to-treat analysis

Not Observed (n=112)

Observe (n=752)

Observe (n=873)

Not Observed (n=209)

IV analysis

Did not enroll in DLI in K (non-compliers) (n=172)

Enrolled in DLI in K (compliers) (n=580)

Did not enroll in DLI in K (compliers) (n=636)

Enrolled in DLI in K (non-compliers) (n=237)

RAND
<table>
<thead>
<tr>
<th>Variable (%)</th>
<th>Binding Lottery Applicants</th>
<th>All PPS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All</td>
<td>Win</td>
</tr>
<tr>
<td>N</td>
<td>1,625</td>
<td>752</td>
</tr>
<tr>
<td>Proportion</td>
<td>46.3</td>
<td>53.7</td>
</tr>
<tr>
<td>Female</td>
<td>52.9</td>
<td>50.8</td>
</tr>
<tr>
<td>Asian</td>
<td>14.4</td>
<td>17.8</td>
</tr>
<tr>
<td>Black</td>
<td>5.6</td>
<td>5.2</td>
</tr>
<tr>
<td>Hispanic</td>
<td>17.0</td>
<td>17.7</td>
</tr>
<tr>
<td>White</td>
<td>54.0</td>
<td>51.7</td>
</tr>
<tr>
<td>Other/Miss Race</td>
<td>6.8</td>
<td>6.3</td>
</tr>
<tr>
<td>FARMS</td>
<td>26.0</td>
<td>27.3</td>
</tr>
<tr>
<td>Sp. Needs in K</td>
<td>4.1</td>
<td>5.2</td>
</tr>
<tr>
<td>Gifted in K</td>
<td>4.0</td>
<td>4.4</td>
</tr>
<tr>
<td>EL in K</td>
<td>12.7</td>
<td>5.3</td>
</tr>
<tr>
<td>First Lang Not Eng.</td>
<td>17.8</td>
<td>20.6</td>
</tr>
<tr>
<td>First Lang Partner</td>
<td>6.3</td>
<td>9.2</td>
</tr>
</tbody>
</table>

Lottery Sample Is More Observably Balanced than Full Sample
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In Reading, Lottery Estimates are Positive and Significant in Grades 5 and 8

Lottery ITT effects reflect about 7 months of additional reading skills in grade 5 and about 9 months in grade 8.
In Math and Science, Lottery Estimates are Not Statistically Distinguishable from Zero

Larger estimates in full sample relative to lottery analysis suggest presence of selection bias in full sample.
Estimates Do Not Differ Significantly by Program Type or Native Language Status

- Reading, math, and science estimates are statistically similar for
  - two-way vs. one-way programs
  - Spanish vs. other languages (Mandarin, Japanese, Russian)
  - native speakers of English vs. native speakers of other languages
  - students whose native language matches vs. does not match the partner language

- Modest but statistically non-significant evidence that immersion benefit in reading is higher for students in Spanish programs, and immersion benefit in math is higher for students in less-commonly-taught languages

- Reading effects for students whose native language matches partner language appear as high as or higher than for native English speakers
Immersion Students Less Likely to be ELL by Gr. 5 & 6

ELL Classification Effect Estimates

Estimated Effects (SD Units)

Grade

1 2 3 4 5 6 7 8

FULL

ITT

IV

(Solid Marks): Signif. at 5%

Immersion Students Reach Intermediate Partner Language Proficiency by Gr. 8
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Immersion Effects Are Not Explained by Peer or Teacher Characteristics or Class Size

• Based on 2012-13 data, winning the immersion lottery yields:
  o 1.8 percentage points more ELLs in classroom
  o 3.0 percentage points fewer special education peers
  o 1.3 fewer years of teacher experience
  o 1.8 percentage points lower probability that teacher is “highly qualified” under NCLB
  o No significant difference in subsidized meal eligibility, share of talented & gifted peers, or class size

• None of these differences help account for the estimated effects of winning the immersion lottery
In 2014, 14 principals were interviewed at length about relative inputs in DLI and non-DLI programs:

- Principals’ time devoted to particular tasks
- Teacher workload
- Parent volunteerism
- Field trips
- Technology
- External funding sources
- Other resource differences
No Evidence of Differential DLI Costs at School Level

• Principals of immersion schools reported proportional effort on their immersion and non-immersion programs.

• Principals’ reports of fundraising, volunteering, and other resources suggest proportional immersion and non-immersion resources.

• Our analyses of class sizes within and between schools by grade suggests few differences between immersion and non-immersion classes.

• DLI-specific expenditures appear concentrated in district-level support, and are modest.
DLI Operating Costs in 2013-14 Were About 0.1% of District Budget

District Expenditures In Thousands, 2013-14

- District Operating Expenditures: 537,275
- DLI Expenditures (from Operating Budget, excl. External Grants): 562
- DLI Central Staffing: 117
- DLI Central Support (PD Pay/Logistics, Supplem. Materials): 387
DLI Operating Costs Per Pupil Were Also Modest

<table>
<thead>
<tr>
<th>Avg Dist Per Pupil non-DLI (n=41,864)</th>
<th>Avg Per Pupil DLI (n=4,108)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11,675</td>
<td>11,812</td>
</tr>
</tbody>
</table>

$137 (1.2\%)$ differential, but prior years were lower

Based on 2013-14, $10 per pupil across K-8 would’ve bought about a day of additional reading skills in grade 5, and about 1.3 days in grade 8

Actual costs since 2004-05 were likely much less
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We Collected Feedback from Principals

- Year 1: Interviewed 17 principals
- Year 2: Interviewed 15 principals
- Key topics
  - Teacher quality
  - Resources
Principals Emphasized the Importance of Hiring the Right Teachers

• Limited number of licensed candidates with adequate language proficiency
  – Even greater concern in middle and high schools
• Competition for qualified teachers
• Need to hire freely, rather than seniority-based
• Principals emphasized the link between teacher quality and the success of the immersion program
  – Families tend to opt out when dissatisfied with teaching quality
We Also Collected Feedback from Teachers

• Year 1: Conducted focus groups with 32 of the 107 DLI teachers
  – Including teachers from elementary, middle, and high school
  – Across all partner languages
• Year 2: Interviewed 32 teachers individually about workload and support from the district
Teachers Reported the Challenges They Face

- Immersion teachers face additional challenges related to materials
  - Often need to create them themselves
- Additional prep time can be substantial and risks teacher burnout
- Average hours of additional prep time: 15 hrs/wk
  - Ranged from 2 to 40 hours
- Collaboration is especially important, but hard to find time
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To Document Instruction, We Observed 198 Class Periods in DLI Schools

<table>
<thead>
<tr>
<th>Language</th>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>33</td>
<td>0</td>
</tr>
<tr>
<td>Spanish</td>
<td>26</td>
<td>72</td>
</tr>
<tr>
<td>Japanese</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>Mandarin</td>
<td>7</td>
<td>16</td>
</tr>
<tr>
<td>Russian</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>TOTAL</td>
<td>79</td>
<td>119</td>
</tr>
</tbody>
</table>

YEAR 1
- March-April 2013
- Grades K-12; 19 schools
- Randomly drawn by grade (odd #s) / subject
- One 45-minute period per teacher
- Focused on teaching practices

YEAR 2
- March-June 2014
- Grades 1-7; 13 schools
- Selected by school level, vertical cluster, and grade (odd #s)
- Four 45-minute periods per teacher, over two separate days
- Focused on language use and classroom activities
We Found Strong Use of District-Recommended Teaching Practices

• Objectives defined, displayed, and reviewed
• Emphasizing key vocabulary
• Frequent opportunities for interaction
• Lessons tap all language skills
  (read, write, speak, listen)

• Ratings averaged 3 or higher on a 4-point scale
Teachers Adhered Closely to the Partner Language During Lessons

**Immersion Teachers’ Use of Partner Language**

<table>
<thead>
<tr>
<th>Percent of classes observed</th>
<th>Proportion of teacher’s speech in the partner language</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>52</td>
</tr>
<tr>
<td>90-99%</td>
<td>46</td>
</tr>
<tr>
<td>80-99%</td>
<td>1</td>
</tr>
<tr>
<td>70-79%</td>
<td>1</td>
</tr>
</tbody>
</table>
Students Varied More In Their Use of the Partner Language With Teachers

Students’ Use of Partner Language in Speaking to Teacher as Part of the Lesson Activities

Percent of classes observed

Proportion of students’ speech in the partner language

- 100%: 22
- 90-99%: 60
- 80-89%: 4
- 70-79%: 10
- 60-69%: 1
- 50-59%: 1
- 40-49%: 2
- 30-39%: 2
Students Varied Even More In Their Use of the Partner Language With Peers

Students’ Use of Partner Language in Speaking to Peers as Part of the Lesson Activities

<table>
<thead>
<tr>
<th>Proportion of students’ speech in the partner language</th>
<th>Percent of classes observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>14</td>
</tr>
<tr>
<td>80-99%</td>
<td>34</td>
</tr>
<tr>
<td>60-79%</td>
<td>12</td>
</tr>
<tr>
<td>40-59%</td>
<td>5</td>
</tr>
<tr>
<td>20-39%</td>
<td>4</td>
</tr>
<tr>
<td>0-19%</td>
<td>8</td>
</tr>
<tr>
<td>n/a</td>
<td>13</td>
</tr>
</tbody>
</table>
Lessons Provided Students Substantial Opportunities to Speak

Most Common Length of Speech Requested as Part of the Lesson

<table>
<thead>
<tr>
<th>Length of Speech</th>
<th>Percent of Classes Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 = single word</td>
<td>1</td>
</tr>
<tr>
<td>2 = short phrases</td>
<td>2</td>
</tr>
<tr>
<td>3 = one full sentence</td>
<td>11</td>
</tr>
<tr>
<td>4 = two to three sentences</td>
<td>28</td>
</tr>
<tr>
<td>5 = four sentences or longer</td>
<td>53</td>
</tr>
<tr>
<td>n/a = students were not asked to</td>
<td>1</td>
</tr>
<tr>
<td>speak as part of the lesson</td>
<td></td>
</tr>
</tbody>
</table>

Where:
- 1 = single word
- 2 = short phrases
- 3 = one full sentence
- 4 = two to three sentences
- 5 = four sentences or longer
- n/a = students were not asked to speak as part of the lesson
A Large Proportion of Lessons Gave Students Substantial Opportunities to Write

Length of Greatest Opportunity to Write as Part of the Lesson

<table>
<thead>
<tr>
<th>Percent of classes observed</th>
<th>1 = single word</th>
<th>2 = short phrases</th>
<th>3 = one full sentence</th>
<th>4 = two to three sentences</th>
<th>5 = four sentences or longer</th>
<th>n/a = students were not asked to write as part of the lesson</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>13</td>
<td>8</td>
<td>6</td>
<td>28</td>
<td>29</td>
<td>24</td>
</tr>
</tbody>
</table>

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Summary

• Students randomly assigned to immersion outperformed their peers in English reading by about 7 months in grade 5 and 9 months in grade 8

• No significant benefit, but also no detriment, for math and science performance

• Immersion students have 3-point lower ELL classification rates by 6th grade (14 points if native language matches partner languages)

• Immersion students reach intermediate levels of partner-language proficiency by grade 8, with some variation by partner language

• No evidence that peer, teacher, or class size characteristics drive immersion effects
Summary

- Additional costs of immersion have been a small fraction of per-pupil spending in the district.

- Principals emphasized the challenge of finding the right teachers and the importance of doing so.

- Teachers reported substantial need for prep time and the importance of collaboration.

- Observation data (limited to participating teachers on observed days) show more variation in students’ than teachers’ adherence to partner language.

- Effective scaling depends on maintenance of quality, including provision of opportunities for students to use partner language in the classroom.
Looking Ahead: Next Steps for DLI Research

- Examining transitions from elementary to middle and high school: What motivates students and families to persist in immersion programs?
- Expanding our knowledge of partner language proficiency by the end of middle school and high school
- Estimating long-term impacts of DLI on high school graduation rates, college preparedness, and career plans and success
- Improving our understanding of the impact of DLI on “non-cognitive” (e.g., interpersonal and cross-cultural) skills
- Further examining the impacts of DLI on English Learners
- Associating school effectiveness with school and classroom practices
- Understanding the role of DLI in supporting urban school diversity and closing achievement gaps