

Curriculum Effects on Vocabulary Outcomes



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Purpose of this Meta-Analysis



- To determine the effects of early childhood literacy curricula on vocabulary learning for at-risk children

Research Questions: What are the effects of language and literacy curricula on vocabulary?



- Do children at-risk for language/reading delays in early childhood classrooms which implement language and literacy curricula have better **receptive vocabulary** outcomes compared with children in control conditions?
- Do children at-risk for language/reading delays in early childhood classrooms which implement language and literacy curricula have better **expressive vocabulary** outcomes compared with children in control conditions?
- Do children at-risk for language/reading delays in early childhood classrooms which implement language and literacy curricula have better **targeted vocabulary** outcomes compared with children in control conditions?

Secondary Research Questions



- Does type of curriculum affect vocabulary outcomes?
- Does the curriculum instructor affect vocabulary outcomes?

Meta-Analysis Overview



- Meta-analysis
 - Is a quantitative synthesis of literature
 - ✦ Only includes empirical research
 - ✦ Only includes group research
 - Summarizes the effects across studies
 - ✦ By calculation of an effect size for each study
 - ✦ By averaging the effect sizes across studies for an overall effect size of the studies as a group
- This meta-analysis was conducted as explained in Practical Meta-Analysis by Lipsey & Wilson (2001)

Methods: Inclusion Criteria



- **Population:**
 - Children in preschool and kindergarten
 - At least half of the participants were at-risk for language/academic delays due to:
 - ✦ Economic disadvantage
 - ✦ Academic delays or low test scores
 - Judged by the researcher based on child test scores, parent report, or genetic factors

Methods: Inclusion Criteria



- ⚙ Curriculum were defined as written plans that include:
 - ⚙ **goals** for children's development and learning
 - ⚙ **experiences** through which they will achieve these goals;
 - ⚙ **plans for what staff and parents do** to help children achieve these goals;
 - ⚙ the **materials** needed to support the implementation of the curriculum

Based on NAEYC and HS definitions

- ⚙ Additionally, the curriculum used had a language or literacy focus
- ⚙ Included across-activity/full-day curricula (such as OWL, DLM Express) or supplemental curricula (such as dialogic reading or a phonological awareness intervention)

Methods: Inclusion Criteria



- Types of studies
 - Written in English
 - Experimental or quasi-experimental with statistical controls for pretest differences
- Types of outcome measures
 - A vocabulary measure
 - ✦ Standardized or researcher developed
 - ✦ Receptive, expressive, or target vocabulary

Methods: Selection of Studies



Search Source	Search Terms	No. of Abstracts
Search of internet databases (including ERIC, PsychINFO, Proquest, and Google Scholar)	Keywords: (preschool, kindergarten, “early childhood”, “young children”, “child care”, “child development centers”, “nursery school”, “early intervention”, elementary, montessori) AND (at-risk, “educationally disadvantaged”, “learning problems”, “academic failure”, “compensatory education”) AND (curriculum, literacy, instruction, reading, writing) AND (vocabulary, lexicon, word knowledge, receptive, expressive), AND (randomized, randomization, “field trial”, study, experiment, quantitative, data)	871
Hand Searches of references from electronic search and previous meta-analyses	References from identified studies	69
	Total Number of Abstracts Reviewed	940

Methods: Selection of Studies



- Phase 1: abstracts were screened for inclusion criteria
 - 940 → 192
- Phase 2: full text study reports were reviewed
 - 192 → 64
- Phase 3: full coding for group comparison analysis
 - 64 → 44 independent studies from 33 reports

- Primary reasons for exclusion were
 - ✦ no vocabulary outcome,
 - ✦ no comparison group,
 - ✦ a non-literacy curriculum as the treatment

Methods: Coding Data



- Two reviewers independently coded each full article using a detailed coding protocol
- Coding disagreements were discussed and resolved so that only data with perfect agreement was included in the analysis.

Methods: Data Synthesis



- Independence of effect sizes
 - Multiple treatment conditions
 - ✦ Chose the most intensive intervention condition or the condition which reflected an overall or oral language curriculum
 - Multiple cohorts
 - ✦ Analyzed separately only when separate control groups reported
 - Multiple measures
 - ✦ Constructs analyzed separately
 - ✦ When multiple measures of the same construct the effect sizes were averaged

Methods: Data Synthesis



- Effect size calculations

- When means and standard deviations were provided: $ES_{sm} = \frac{\bar{X}_{G1} - \bar{X}_{G2}}{S_p}$

- When F values were provided: $ES_{sm} = \sqrt{\frac{(1 - r^2)F(n_1 + n_2)}{n_1 n_2}}$

- Effect size adjustments

- Cluster adjustments

- ✦ Studies which randomized by units other than child (classroom or center) or that were quasi-experimental were adjusted for clustering of data

- Hedges small sample correction $ES'_{sm} = \left[1 - \frac{3}{4N - 9}\right] ES_{sm}$

Methods: Statistical Model

- Random effects model

- Standard error for each effect size: $SE = \sqrt{v_{\theta} + v_i}$
 - ✦ v_i is the estimate of the variance associated with subject level sampling error

$$v_i = \frac{n_{G1} + n_{G2}}{n_{G1}n_{G2}} + \frac{(ES'_{sm})^2}{2(n_{G1} + n_{G2})}$$

- ✦ v_{θ} is the estimate of the random or between-studies variance component; it was estimated through SPSS meta-analysis macros (Lipsey & Wilson, 2001)
- Mean effect size was calculated by weighting each adjusted effect size by the inverse of its variance.

$$w_i^* = \frac{1}{v_{\theta} + v_i}$$

Results: Study Characteristics

- Total Studies: 44 from 33 reports
- Number of participants
 - Treatment: 2,260
 - Control: 2,059
- Publication:
 - ✦ Published: 34 (77%)
 - ✦ Unpublished: 10 (23%)
- Publication Year:
 - ✦ 1960 – 1970: 1 (2%)
 - ✦ 1980 – 1990: 2 (5%)
 - ✦ 1991 – 2000: 11 (26%)
 - ✦ 2001 – 2009: 30 (68%)

Results: Study Characteristics



Curriculum Focus by Participant Risk Factors

	Overall literacy	Oral language	Phonemic Awareness	Print Awareness	Overall development with literacy component	<i>Total</i>
Economic disadvantage	15	6	0	1	5	<i>26</i>
Academic risk	1	4	3	0	0	<i>8</i>
Multiple risk factors	0	8	1	0	0	<i>9</i>
<i>Total</i>	<i>16</i>	<i>18</i>	<i>4</i>	<i>1</i>	<i>5</i>	

Results: Study Characteristics



Treatment Duration by Curriculum Intensity

	Full day curricula	Supplemental curricula	<i>Total</i>
15 weeks or less	0	15	<i>15</i>
16 weeks or more	10	19	<i>29</i>
<i>Total</i>	<i>10</i>	<i>34</i>	

- ✦ Curriculum implementer:
 - Teacher: 37 (84%)
 - Researcher: 7 (16%)

Results: Receptive Vocabulary Measures



- Overall effect size for receptive measures was .10 ($p < .05$)
 - ES Range = - .49 - 1.31
 - 32 Studies
 - Receptive Measures reported:
 - ✦ PPVT (Revised, Third Edition, Hebrew version, Danish version)
 - ✦ TOLD picture vocabulary

In practical terms this means, on average experimental children scored 1.5 points higher on the PPVT than the control children on the post test.

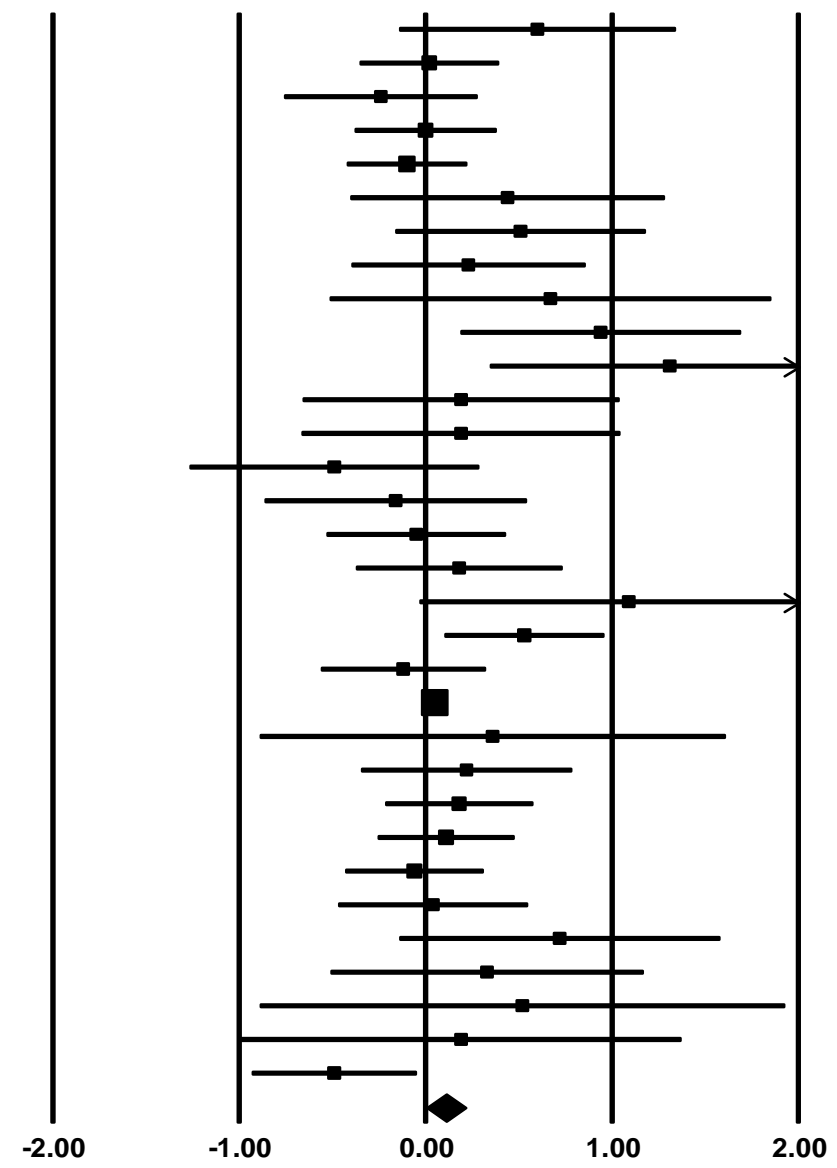


Study name

Statistics for each study

Std diff in means and 95% CI

		Std diff in means	Standard error	p-Value
AIR, 1969	General plus literacy	0.60	0.38	0.11
Fischel et al, 2007	General plus literacy	0.02	0.19	0.92
NCER, 2008, Study 2	General plus literacy	-0.24	0.27	0.37
NCER, 2008, Study 4	General plus literacy	0.00	0.20	1.00
NCER, 2008, Study 7	General plus literacy	-0.10	0.17	0.54
Wasik & Bond, 2001	Oral language	0.44	0.43	0.31
Karweit, 1989, Study 1	Oral language	0.51	0.34	0.14
Karweit, 1989, Study 2	Oral language	0.23	0.32	0.47
Wasik et al, 2006	Oral language	0.67	0.60	0.27
vanKleeck et al, 2006	Oral language	0.94	0.38	0.01
Valdez-Menchaca & Whitehurst, 1992	Oral language	1.31	0.49	0.01
Crain-Thorenson & Dale, 1999	Oral language	0.19	0.43	0.66
Hargrave & Senechal, 2000	Oral language	0.19	0.44	0.66
Lonigan & Whitehurst, 1998, Study 1	Oral language	-0.49	0.40	0.22
Lonigan & Whitehurst, 1998, Study 2	Oral language	-0.16	0.36	0.66
Lonigan et al, 1999	Oral language	-0.05	0.25	0.84
Whitehurst et al, 1994	Oral language	0.18	0.28	0.53
Gunn et al, 2006	Overall literacy	1.09	0.57	0.06
Hadley 2000	Overall literacy	0.53	0.22	0.02
Simmons et al, 2007	Overall literacy	-0.12	0.23	0.60
Landry et al, 2006	Overall literacy	0.05	0.03	0.15
Berman & Moyle, 2006	Overall literacy	0.36	0.64	0.57
Gettinger & Stoiber, 2008	Overall literacy	0.22	0.29	0.45
NCER, 2008, Study 1	Overall literacy	0.18	0.20	0.38
NCER, 2008, Study 3	Overall literacy	0.11	0.19	0.56
NCER, 2008, Study 5	Overall literacy	-0.06	0.19	0.75
NCER, 2008, Study 6	Overall literacy	0.04	0.26	0.88
Aram, 2006, Study 1	Overall literacy	0.72	0.44	0.10
Aram, 2006, Study 2	Overall literacy	0.33	0.43	0.44
O'Connor et al, 1996, Study 1	Phonemic awareness	0.52	0.72	0.47
O'Connor et al, 1996, Study 2	Phonemic awareness	0.19	0.60	0.75
Elbro & Petersen, 2004	Phonemic awareness	-0.49	0.23	0.03
		-	-	-



Moderator Analyses



- Moderator analyses were used to determine differential effects by study characteristics
- For receptive and expressive measures, we looked at 2 possible moderators of intervention effects
 - Type of curriculum
 - ✦ General literacy/general curriculum with literacy
 - ✦ Specific literacy component
 - Instructor
 - ✦ Teacher
 - ✦ Researcher

Receptive Vocabulary Outcomes: Curriculum is a moderator



- Type of curriculum
 - General literacy or general plus literacy
 - ✦ 17 studies
 - ✦ ES = .06
 - ✦ On average, the experimental participants who received a general curriculum scored .9 points higher than control on the PPVT
 - Specific literacy skills (oral language/vocabulary, phonological awareness, print awareness)
 - ✦ 15 studies
 - ✦ ES = .11
 - ✦ On average, the experimental participants who received a specific curriculum scored 3.6 points higher than control on the PPVT

Receptive Vocabulary Outcomes: Implementation agent is a moderator



- Instructor

- Teacher

- ✦ 26 studies
- ✦ ES = .07
- ✦ On average, the experimental participants who were taught by teachers scored 1.1 points higher than control on the PPVT

- Researcher

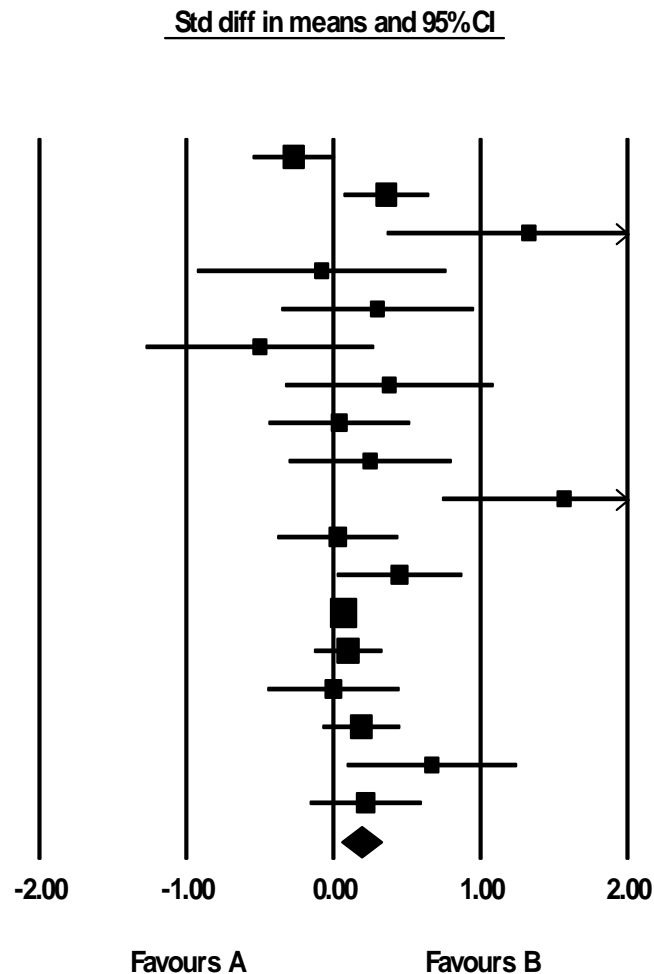
- ✦ 5 studies
- ✦ ES = .44
- ✦ On average, the experimental participants who were taught by researchers scored 6.6 points higher than control on the PPVT

Results: Expressive Vocabulary Measures



- Overall effect size for expressive measures was .21 (p=0.01)
 - ES Range = -.50 – 1.57
 - 18 studies
 - Expressive measures:
 - ✦ Number of Different Words (from language samples)
 - ✦ EVT
 - ✦ EOWPVT
 - ✦ Get it, Got it, Go! Picture Naming
 - ✦ CELF expressive subtest
- In practical terms this means, on average, experimental children scored 3.2 points higher on the EVT than the control children on the post test

<u>Study name</u>	<u>Curriculum focus</u>	<u>Statistics for each study</u>		
		Std diff in means	Standard error	p-Value
Justice et al, 2008	Oral language	-0.27	0.14	0.06
Wasik et al, 2006	Oral language	0.36	0.15	0.02
Valdez-Menchaca & Whitehurst, 1992	Oral language	1.33	0.49	0.01
Crain-Thorenson & Dale, 1999	Oral language	-0.08	0.43	0.85
Hargrave & Senechal, 2000	Oral language	0.30	0.34	0.37
Lonigan & Whitehurst, 1998, Study 1	Oral language	-0.50	0.40	0.21
Lonigan & Whitehurst, 1998, Study 2	Oral language	0.38	0.36	0.29
Lonigan et al, 1999	Oral language	0.04	0.25	0.87
Whitehurst et al, 1994	Oral language	0.25	0.28	0.38
Paulson et al, 2004	Overall literacy	1.57	0.42	0.00
Scott 2005	Overall literacy	0.03	0.21	0.89
Hadley 2000	Overall literacy	0.45	0.22	0.04
Landry et al, 2006	Overall literacy	0.07	0.03	0.04
Whitehurst et al, 1999	Overall literacy	0.10	0.12	0.40
Debaryshe & Gorecki, 2007	Overall literacy	0.00	0.23	1.00
Bailet et al, 2009	Overall literacy	0.19	0.14	0.16
Gettinger & Stoiber, 2008	Overall literacy	0.67	0.30	0.02
Justice et al, 2009	Print awareness	0.22	0.19	0.26




Expressive Vocabulary : Type of curriculum moderates outcomes



- Type of curriculum
 - General literacy or general plus literacy
 - ✦ $N = 7$
 - ✦ $ES = .24$
 - ✦ On average, the experimental participants who received a general curriculum scored 3.6 points higher than control on the EVT
 - Specific literacy skills (oral language/vocabulary, phonological awareness, print awareness)
 - ✦ $N = 11$
 - ✦ $ES = .14$
 - ✦ On average, the experimental participants who received a specific curriculum scored 2.1 points higher than control on the EVT

Expressive Vocabulary :Implementation

agent moderates outcomes



- Instructor

- Teacher

- ✦ N = 16

- ✦ ES = .14

- ✦ On average, the experimental participants who were instructed by teachers scored 2.1 points higher than control

- Researcher

- ✦ N = 2

- ✦ ES = .31

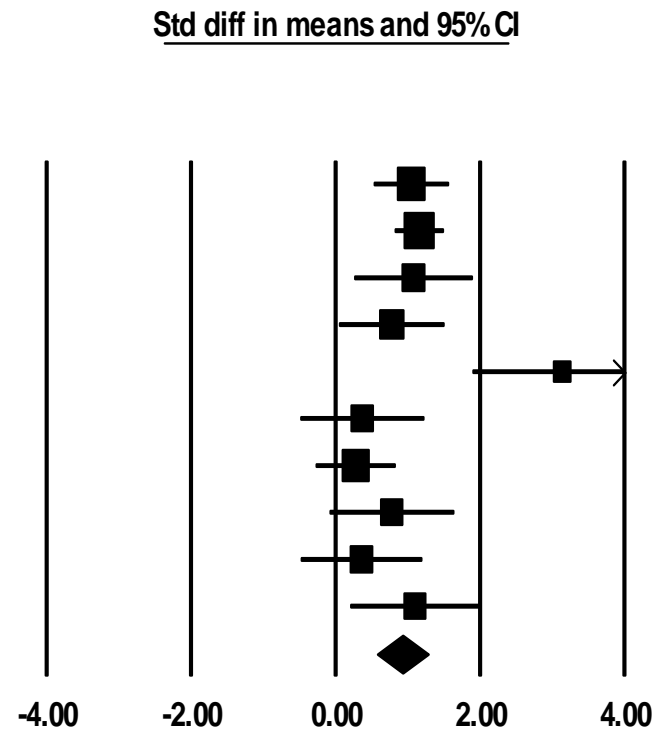
- ✦ On average, the experimental participants who were instructed by researchers scored 4.7 points higher than control

Results: Curriculum Specific Measures - Targeted Words



- Overall effect size for curriculum specific measures of targeted words was 1.01 (p=.000)
 - ES Range = .28 – 3.14
 - 10 studies
 - Target measures
 - ✦ Researcher developed measures
 - ✦ Measured:
 - Receptive knowledge of target words
 - Expressive knowledge of target words
 - Definitional knowledge of target words
 - ✦ Range of 18 – 60 words on target word measures
 - Mean of 33 words per test

<u>Study name</u>	<u>Outcome</u>	<u>Statistics for each study</u>		
		Std diff in means	Standard error	p-Value
Coyne et al, 2004	Taught vocabulary	1.05	0.27	0.00
Bowyer-Crane et al, 2008	Specific vocabulary	1.16	0.18	0.00
Justice et al, 2005, Study 1	Elaborated vocabulary	1.08	0.42	0.01
Justice et al, 2005, Study 2	Elaborated vocabulary	0.78	0.37	0.04
Wasik & Bond, 2001	Average	3.14	0.64	0.00
Hargrave & Senechal, 2000	Book Vocabulary	0.37	0.44	0.40
Whitehurst et al, 1994	Our Word - expressive	0.28	0.28	0.32
Aram, 2006, Study 1	Book Vocabulary	0.78	0.44	0.08
Aram, 2006, Study 2	Book Vocabulary	0.36	0.43	0.40
Beck & McKeown, 2007	Target Vocabulary	1.10	0.46	0.02



Curriculum Specific Measures: Untargeted words



- Overall the effect size for curriculum specific measures of untargeted words was .29 ($p = .116$)
 - ES Range = .26 - .39
 - 3 studies
 - Measures:
 - ✦ Untaught vocabulary
 - ✦ Unelaborated vocabulary

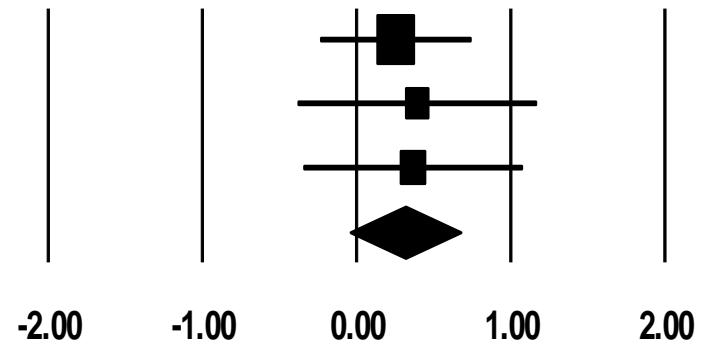
Study name

Outcome

Statistics for each study

Std diff in means and 95% CI

		Std diff in means	Standard error	p-Value
Coyne et al, 2004	Untaught vocabulary	0.26	0.25	0.31
Justice et al, 2005, Study 1	Non-elaborated words	0.39	0.40	0.32
Justice et al, 2005, Study 2	Non-elaborated words	0.37	0.36	0.31



Outcomes Summary

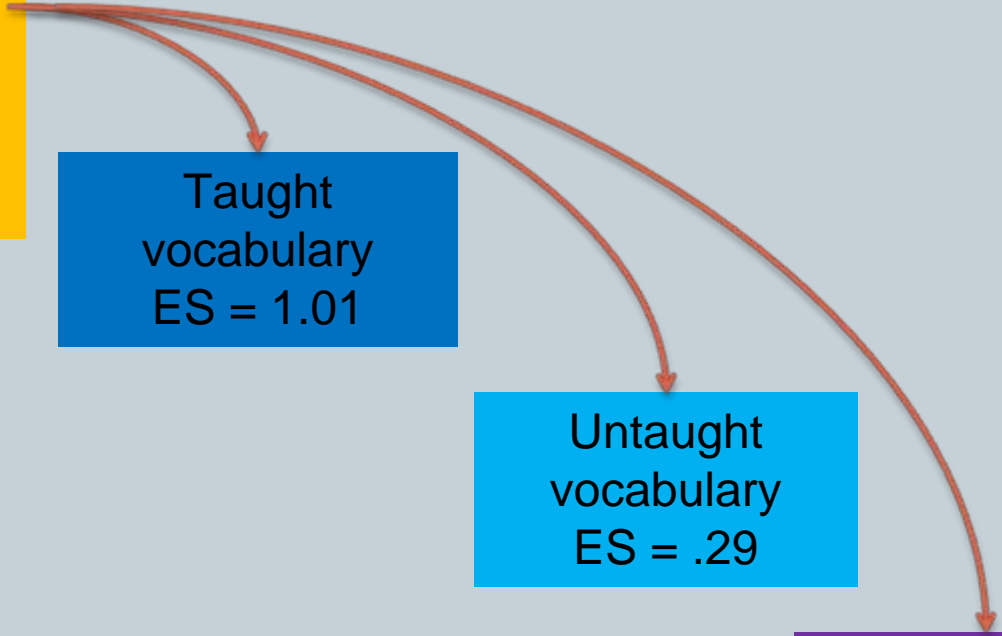


Early Childhood
Literacy Curriculum
Interventions

Taught
vocabulary
ES = 1.01

Untaught
vocabulary
ES = .29

Standardized
assessments
ES = .11, .21



Concluding Thoughts and Questions



Early literacy and language curricula have a *statistically significant* effect on child vocabulary outcomes

- ✦ Although the effect is statistically significant, is it practically significant?

The greatest differences in favor of the experimental group were seen on target vocabulary measures

- ✦ How does this translate to standardized measures?
- ✦ Does the significant difference in standardized measures increase over time due to cumulative vocabulary learning?

Concluding Thoughts and Questions



Focused curricula have a greater effect than overall literacy curricula on receptive measures

- Are there less opportunities to target specific vocabulary in general curricula or are the strategies not as well defined because there is more material to cover?

Teacher-implemented curricula are less effective in increasing receptive and expressive vocabulary measures than researcher-implemented curricula

- Is this a matter of fidelity of implementation or some other factor?

Implications for improving vocabulary outcomes for children at risk



- Is it feasible to follow the evidence –based recommendation ?
- Use a skill specific curriculum
- Use research staff to implement the curriculum
- Expect largest effects on specific targeted vocabulary
- Expect modest effects on standardized assessment

- **Caveats:**
 - Only short term outcomes considered here
 - Few measures of implementation fidelity
 - Small number of studies limits robust moderator analyses



For further information



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