How should we teach vocabulary?
Implications from meta-analytic reviews of L2 vocabulary learning studies

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Overview

• What is meta-analysis?
• How much vocabulary can be learned from context?
• How can we support vocabulary learning from context?
  • Repetition & vocabulary learning
  • Glossing & vocabulary learning
• How much vocabulary can be learned through word-focused activities?
• Summary & Implications
What is meta-analysis?

**Narrow definition**
- A statistical method for calculating the mean and the variance of a collection of effect sizes (e.g., Pearson’s r, Cohen’s d) across studies

**Example research question**
- What is the average correlation between vocabulary size and TOEFL score?

→ the overall effect = 0.76
What is meta-analysis?

Moderator analysis

• What factors explain effect-size variability across studies?

Example research question

• Does context (EFL vs. ESL) explain the variability across studies?

<table>
<thead>
<tr>
<th>Study ID</th>
<th>Year</th>
<th>Context</th>
<th>N</th>
<th>Pearson r</th>
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<tbody>
<tr>
<td>Author A</td>
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</tr>
<tr>
<td>Author C</td>
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<td>0.54</td>
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<td>0.86</td>
</tr>
<tr>
<td>Author E</td>
<td>2018</td>
<td>ESL</td>
<td>33</td>
<td>0.83</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>
What is meta-analysis?

**Moderator analysis**

• What factors explain effect-size variability across studies?

➢ What are moderator variables?

**Example research question**

• Does context (EFL vs. ESL) explain the variability across studies?

• Go to Dr. Luke Plonsky’s website [https://lukeplonsky.wordpress.com/](https://lukeplonsky.wordpress.com/)

• See Boers et al. (2020) for a critical review of meta-analysis

<table>
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<tr>
<td>...</td>
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<td>...</td>
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</tbody>
</table>
A list of meta-analysis on L2 vocabulary learning studies

**Incidental vocabulary learning**
- Montero Perez et al. (2013)
- de Vos et al. (2018)
- Nakanishi (2015)
- Uchihara et al. (2019)
- Webb et al. (under review)

**Intentional vocabulary learning**
- Webb et al. (2020)

**Conditions contributing to learning**
- Huang et al. (2012)
- Yanagisawa & Webb (2021)

**Glossing**
- Abraham (2008)
- Yun (2011)
- Yanagisawa et al. (2020)
- Ramezanali et al. (2020)
- Zhang & Zhang (2020)

**Dictionary use**
- Zhang et al. (2020)

**Corpus use**
- Lee et al. (2018)

**Strategy training**
- Plonsky (2011)
How much vocabulary can be learned from context?

**Incidental vocabulary learning**

- Learning words as a by-product of comprehension-based activities (e.g., reading, listening, watching television)
- No explicit focus on vocabulary learning
L1 incidental vocabulary learning from reading

- School children appear to increase L1 vocabularies by thousands of words per year through reading written texts (Nagy et al., 1985)

- A meta-analysis of 15 studies (Swanborn & de Glopper, 1999)
  - Students (Grade 5\textsuperscript{th} to 11\textsuperscript{th}) learn around 15\% of the unknown words encountered while reading
L2 incidental vocabulary learning

Meta-analysis of 22 studies
• L1 = Arabic, Chinese, Thai, Japanese, Spanish …
• L2 = English and German (k = 1)

Study design

<table>
<thead>
<tr>
<th>Treatment (n = 1,448)</th>
<th>Control (n = 1,205)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Reading, Reading+Listening, Listening,</td>
<td>• Test-only condition</td>
</tr>
<tr>
<td>Viewing</td>
<td>• No exposure to target words</td>
</tr>
<tr>
<td>• Exposure to target words</td>
<td></td>
</tr>
<tr>
<td>• No forewarning of vocabulary posttests</td>
<td></td>
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</table>

Webb, Uchihara, & Yanagisawa (under review)
# Moderator variables

<table>
<thead>
<tr>
<th>Coding Scheme</th>
<th>Variables</th>
<th>Values</th>
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</thead>
<tbody>
<tr>
<td><em>Publication information</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Authors</td>
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<tr>
<td>Year</td>
<td></td>
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</tr>
<tr>
<td>Source</td>
<td>Journal</td>
<td>MA/PhD thesis</td>
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<tr>
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<tr>
<td><em>Learner variables</em></td>
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<td>Sample size</td>
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<tr>
<td>Participants’ L1</td>
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<tr>
<td>Target language</td>
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<td>L2 proficiency</td>
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<td>Beyond basic</td>
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<td>Institutional level</td>
<td>Primary</td>
<td>Secondary</td>
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<tr>
<td><em>Material and activity features</em></td>
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<tr>
<td>Text type</td>
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<td>Expository</td>
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<td>Text audience</td>
<td>L1 users</td>
<td>L2 learners</td>
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<tr>
<td>Spacing</td>
<td>Spaced</td>
<td>Massed</td>
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<tr>
<td>Mode of input</td>
<td>Reading</td>
<td>Listening</td>
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<td></td>
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<td><em>Methodological features</em></td>
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<td>Pre-knowledge control</td>
<td>Nonword use</td>
<td>Pilot testing</td>
</tr>
<tr>
<td>Test format</td>
<td>Form recognition</td>
<td>Meaning recognition</td>
</tr>
</tbody>
</table>
Moderator variables

**Text audience** (2 categories)
- Texts for L1 users
- Texts for L2 learners (e.g., graded readers)

**Spacing** (2 categories)
- Spaced learning condition
- Massed learning condition
  - Spaced = exposure to target words over time (more than 1 day)
  - Massed = one-time (1-day) exposure to target words

**Mode of input** (4 categories)
- Reading
- Reading while listening
- Listening
- Viewing
Results

- Immediate posttest: \( g = 1.14 \) (Large)
- Delayed posttest: \( g = 1.01 \) (Large)

✓ Small = 0.40, Medium = 0.70, Large = 1.00 (Plonsky & Oswald, 2014)
Moderator analysis (immediate posttest)

**Text audience**
- Text for L2 learners ($g = 1.54$) > Text for L1 users ($g = 0.75$)
✓ Text difficulty influences the rate of learning

**Spacing**
- Spaced learning ($g = 1.51$) > Massed learning ($g = 0.96$)
✓ Exposure over time is better than a one-day intensive exposure

**Mode of input**
- Reading ($g = 1.45$)
- Listening ($g = 0.97$)
- Reading while listening ($g = 0.78$)
- Viewing ($g = 0.48$)
✓ Reading is an important source for incidental vocabulary learning
Rate of learning (number of words learned / total number of target words)

Immediate & delayed posttest

- Reading: 17% & 15%
- Listening: 17% & 16%
- Reading+Listening: 13% & 19%
- Viewing: 4.5%

✓ The amount of learning through reading in L2 is comparable to that in L1 (i.e., 15%, Swanborn & de Glopper, 1999)
✓ Viewing is not as effective a source of input as other modes of input
Implications

• Learning occurs incidentally (13 to 19%, except viewing)
  ➢ L2 readers may learn as much vocabulary as L1 students (15% gain)

• Text difficulty needs to be appropriate for learners
  ➢ About 98% of the words in texts should be known (Hu & Nation, 2000)

• Repeated exposure needs to be spread out (see Nakata & Elgort, 2020)
  ➢ Narrow reading and viewing => encounter the same words repeatedly

• Viewing may not be as useful as other types of input
  ➢ Captioning supports learning: Captioned viewing > Non captioned viewing
    \((g = 0.87)\) (Montero Perez et al., 2013)

• However, incidental learning may not be sufficient for FL adult learners
  (i.e., limited amount of input, limited class time, motivation etc.)
How can we support incidental vocabulary learning?

• What should we do, as a teacher or material writer, to promote vocabulary learning from context? (15% => ??)
  □ Dictionary use
  □ Inference strategy training
  □ Provide glosses
  □ Provide captions / L1 subtitles
  □ Increase the number of word occurrences
  □ Input enhancement (e.g., bold type face, highlighting, exaggeration)
  □ Spacing encounters
  □ etc
To what extent does repetition support L2 incidental vocabulary learning?

The Effects of Repetition on Incidental Vocabulary Learning: A Meta-Analysis of Correlational Studies

Takumi Uchihara, Stuart Webb, Akifumi Yanagisawa


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Repetition in incidental vocabulary learning

Goal of the study
• Explore the overall effect of repetition on incidental vocabulary learning & factors moderating the effect (k = 26 studies)

Target effect size
• Correlation between the number of encounters and learning gains

Life in London
I have lived in London for one year. I think living in an English-speaking country is the best way to improve English skills and enrich your life experience. Have you ever lived abroad? If you haven’t, I highly recommend you should consider living in other countries.

“Live” x 4 encounters => larger learning gain
“Country” x 2 encounters => smaller learning gain
Results & Implications

• The overall correlation was moderate: $r = .34$

• Mode of input
  • Reading: $r = .41$
  • Listening: $r = .39$
  • Reading + listening: $r = .28$
  • Viewing: $r = .22$

➢ Ensuring repeated encounters with L2 words is important especially in designing reading (and listening) materials
➢ Repetition is not a single factor resulting in incidental vocabulary learning
To what extent does glossing support L2 vocabulary learning from reading?

**Different types of glosses**

1. Marginal glosses
2. Interlinear glosses
3. In-text glosses
4. Glossaries
5. Multiple-choice glosses
6. Hyperlinked glosses
1. Marginal glosses

Each year in the U.S. about 7,000 infants die in their cribs for no apparent reason. In 2019, the number has decreased. However, it appears that the vast majority of parents are still not …

Crib = babies’ beds (L2)
Crib = ベビーベッド (L1)
2. Interlinear glosses

Each year in the U.S. about 7,000 infants die in their **cribs** for no apparent reason.

Cribs = babies’ beds

In 2019, the number has decreased. However, it appears that the vast majority of parents are still not …
3. In-text glosses

Each year in the U.S. about 7,000 infants die in their cribs, babies’ beds, for no apparent reason. In 2019, the number has decreased. However, it appears that the vast majority of parents are still not …
4. Glossaries

Each year in the U.S. about 7,000 infants die in their cribs for no apparent reason. In 2019, the number has decreased. However, it appears that the vast majority of parents are still not …

★ Provided at the end of the text or as a separate paper in the form of a list

Vocabulary List

Cribs = babies‘ beds
Decrease = to go down in number or quantity
Infants = babies or very young children
5. Multiple-choice glosses

Each year in the U.S. about 7,000 infants die in their **cribs** for no apparent reason. In 2019, the number has decreased. However, it appears that the vast majority of parents are still not ...

Crib = 1. babies’ beds
2. small beds
6. Hyperlinked glosses

Each year in the U.S. about 7,000 infants die in their cribs for no apparent reason. In 2019, the number has decreased. However, it appears that the vast majority of parents are still not …

Cribs = babies’ beds
Which types of glosses most effectively support L2 vocabulary learning from reading?

### Results

#### TABLE 3. The learning gain for each gloss type compared to the nonglossed condition

<table>
<thead>
<tr>
<th></th>
<th>Immediate</th>
<th>Delayed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$k$</td>
<td>$n$</td>
</tr>
<tr>
<td>Multiple-choice</td>
<td>12</td>
<td>31</td>
</tr>
<tr>
<td>Hyperlinked</td>
<td>11</td>
<td>35</td>
</tr>
<tr>
<td>Marginal</td>
<td>25</td>
<td>69</td>
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<tr>
<td>Glossaries</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Interlinear</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>In-text</td>
<td>4</td>
<td>12</td>
</tr>
</tbody>
</table>

*Note: $k =$ number of studies, $n =$ number of ESs, CI = 95% confidence interval, Mean ES difference (%) = mean effect size differences between each gloss type and the nonglossed condition converted into a percentage. $p =$ $p$-value for significant test.*
Results & Implications

• **Multiple-choice glossing** was most effective
  • 25.2% & 15.6% higher than nonglossed reading (immediate & delayed)

• **Hyperlinked, marginal, & interlinear glosses** are moderately effective

• The least effective gloss types: **Glossaries & In-text glosses**
  • No significant differences when compared to nonglosses reading

• **L1 glossing** led to gains 4% higher than L2 glossing
  • L1 > L2 glossing (g = 0.33) (Kim et al., 2020)

➢ Location of glosses should not be too close to (e.g., in-text glosses) or far from (e.g., glossaries) target words

➢ **L1 glossing** is more effective than L2 glossing
Glossing promotes L2 vocabulary learning from reading

• Different modes of glosses can be presented in combination

• Mode of gloss
  • L1 or L2 texts
  • Pictures
  • Videos
  • Audio

• Commonly used combinations include:
  • Picture + Text (two modes) = dual
  • Picture + Text + Audio (three modes) = triple

• Assumption: multimodal glosses > single-mode glosses
  • Supported by previous meta-analyses: 2 > 1 (e.g., Yun, 2011)

• Does an additional mode of gloss lead to an additional benefit for vocabulary learning? (e.g., 3 > 2, 4 > 3, 5 > 4, etc.)
Does additional modes of input lead to more effective vocabulary learning?


Abstract

This meta-analysis examined the effectiveness of an additional gloss mode in single versus dual and dual versus triple glossing on second language (L2) learners’ word learning. In total, 22 studies, providing 26 independent effect sizes, were coded, and 11 moderator variables including quality of data sample, learner variables, gloss features.

Goal of the study: Explore the effectiveness of an additional gloss mode in (1) single vs. dual & (2) dual vs. triple
Results & Implications

Overall additional mode effect
• $g = 0.46$ (immediate posttest)
• $g = 0.28$ (delayed posttest)
➢ The effect may not be durable (medium => small)

2 vs. 1 & 3 vs. 2
• Dual > Single ($g = 0.58$, $p < .05$)
• Triple = Dual ($g = 0.02$, $p > .05$)
➢ Adding another mode is not always facilitative

Language
• Additional mode (e.g., picture) added to L1 gloss $g = 0.25$
• Additional mode (e.g., picture) added to L2 gloss $g = 0.61$
➢ More effective to add another mode to L2 textual glosses (vs. L1 glosses)
Incidental vs. intentional vocabulary learning

- **Incidental vocabulary learning** is incremental and gradual, requiring large amounts of input over a long period of time.

- In immediate need of learning certain words:
  - Learning technical terms or academic words to keep up in content courses
  - Beginners learn high-frequency L2 words (e.g., like, have, take)
  - Travelers want to learn survival vocabulary (e.g., reservation, top up, delay)

- **Intentional vocabulary learning** (= deliberate vocabulary learning, word-focused learning) is quick and efficient; learners engage in word-focused activities
  - Flashcards, word lists, word-matching, writing, crossword puzzles
• What kinds of word-focused activities are more or less effective than others?

• Which activities should we use in class or encourage learners to use?

• See Webb & Nation (2017) for a list of 23 vocabulary learning activities

How much vocabulary can be learned through word-focused activities?

Four commonly used activities were compared

1. **Flashcards**
   - L2 form => L1 meaning, L1 meaning => L2 form
   - e.g., *Kome (L1) => ________?*
   - e.g., *Rice (L2) => ______?*

2. **Word lists**
   - L1 meaning & L2 form presented together
   - e.g., *Kome (L1) : Rice (L2)*

3. **Writing**
   - Writing sentences using target words

4. **Fill-in-the-blanks**
   - Completing sentences with a blank using target words
   - e.g., *Children who watch a lot of TV do not ________ between reality and fantasy.*
Results (immediate posttest)

<table>
<thead>
<tr>
<th>Activity</th>
<th>k</th>
<th>n</th>
<th>Mean ES (SE)</th>
<th>CI</th>
<th>k</th>
<th>n</th>
<th>Mean ES (SE)</th>
<th>CI</th>
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</thead>
<tbody>
<tr>
<td>Fill-in-the-blanks</td>
<td>8</td>
<td>9</td>
<td>0.431 (0.056)</td>
<td>[0.29, 0.56]</td>
<td>2</td>
<td>3</td>
<td>0.184 (0.042)</td>
<td>[−0.35, 0.72]</td>
</tr>
<tr>
<td>Writing</td>
<td>10</td>
<td>14</td>
<td>0.548 (0.018)</td>
<td>[0.43, 0.66]</td>
<td>4</td>
<td>6</td>
<td>0.368 (0.075)</td>
<td>[0.10, 0.62]</td>
</tr>
<tr>
<td>Word lists</td>
<td>5</td>
<td>11</td>
<td>0.732 (0.075)</td>
<td>[0.51, 0.94]</td>
<td>7</td>
<td>14</td>
<td>0.701 (0.051)</td>
<td>[0.57, 0.83]</td>
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<tr>
<td>Flashcards</td>
<td>2</td>
<td>6</td>
<td>0.770 (0.050)</td>
<td>[0.53, 1.00]</td>
<td>4</td>
<td>14</td>
<td>0.661 (0.048)</td>
<td>[0.50, 0.81]</td>
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</tbody>
</table>

Note. $k =$ number of studies; $n =$ number of ESs; SE = standard error; CI = 95% confidence interval adjusted with RVE. The total number of studies = 20. The total number of ESs = 77.
Results (delayed posttest: 4 days to 2 weeks after the treatment)

<table>
<thead>
<tr>
<th>Activity</th>
<th>k</th>
<th>n</th>
<th>Mean ES (SE)</th>
<th>CI</th>
<th>k</th>
<th>n</th>
<th>Mean ES (SE)</th>
<th>CI</th>
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<tbody>
<tr>
<td>Fill-in-the-blanks</td>
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<td>12</td>
<td>0.289 (0.049)</td>
<td>[0.12, 0.35]</td>
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<td>3</td>
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<td>Writing</td>
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<td>[0.20, 0.43]</td>
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<tr>
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<td>0.218 (0.024)</td>
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<td>0.734 (0.012)</td>
<td>[0.58, 0.88]</td>
<td>4</td>
<td>4</td>
<td>0.320 (0.049)</td>
<td>[0.15, 0.48]</td>
</tr>
</tbody>
</table>

Note. ES = effect size; k = number of studies; n = number of ESs; CI = 95% confidence interval adjusted with RVE. The total number of studies = 15. The total number of ESs = 62.

60%, 59% (Immediate posttest) => 40%, 25% (delayed posttest)
Implications

• **Flashcards & Word Lists** are the most effective activities
  • 66-77% gains (immediate posttest)
  • But less so for delayed posttests (22-48%) (except flashcards for meaning recall, 73%)

• Intentional vocabulary learning: **40%, 25%** (delayed posttest)
  • VS. **15%** for incidental learning from reading (delayed posttest)

➢ Learning from word-focused tasks is far from guaranteed
Summary: How should we teach vocabulary?

• Increase repetitions & space them
  ➢ Narrow reading, listening, and viewing

• Support meaning-focused input with captions and glosses

• In using glosses, remember that:
  • L1 glosses lead to word learning more efficiently than L2 glosses
  • Multiple-choice glosses lead to better learning, but glossaries and in-text glosses should be avoided
  • Two gloss modes are more effective than single mode glosses, but three gloss modes might not further promote learning compared to two modes
  • Adding another gloss to L2 textual glosses increases learning significantly
• Use flashcards effectively
  • Direction of learning
    ➢ L1 meaning => L2 form, L2 form => L1 meaning
    ➢ e.g, Kome => _______?  Rice => ________?
  • The spacing of repetitions
  • Changing the order of the cards to avoid serial learning
  • Use apps and save time (see Nakata, 2011)
  • For a review, see Nakata (2020)
• Supplement word-focused activities with meaning-focused input+output activities (e.g., linked skills, Webb & Nation, 2017)

➢ Flashcard learning => Reading => Discussing with peers => essay writing

<table>
<thead>
<tr>
<th>Context</th>
<th>Rec or Pro</th>
<th>Rec + W + WithCon</th>
<th>Rec + Pro + S + WithCon</th>
<th>Pro + W + WithCon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode</td>
<td>S or W</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Direction</td>
<td>WithoutCon</td>
<td></td>
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<tr>
<td>Mode</td>
<td>S or W</td>
<td></td>
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- Context (with or without)
- Rec or Pro
- S or W
- WithoutCon
- Rec + W + WithCon
- Rec + Pro + S + WithCon
- Pro + W + WithCon

Direction (receptive or productive)

Mode (spoken or written)
How should we teach vocabulary?

Suggestions from other meta-analysis research

• Output practice (Huang et al., 2012)
• Oral interaction (de Vos et al., 2018)
• Dictionary (Zhang et al., 2020)
• Corpus (Lee et al., 2018)
• Learning strategy (Plonsky, 2011)
• Spaced retrieval (Kim & Webb, under review)
• Avoid semantically related words (Nakata & Suzuki, 2019)
• Depth of processing (Yanagisawa & Webb, 2021)
Future directions

• Most studies focus on form-meaning connection (e.g., via cued translation or multiple choice tests)
  ➢ Collocation
  ➢ Pronunciation
  ➢ Appropriateness/pragmatics

• Few replication studies
  ➢ Same research design and materials in virtual environments
References


