Thursday, August 17th, 2023 (15:40~16:00), University of Iceland
Veröld Building – House of Vigdís, Room 108

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The Effects of Interleaved Spaced Repetition on Academic Vocabulary Knowledge Acquisition

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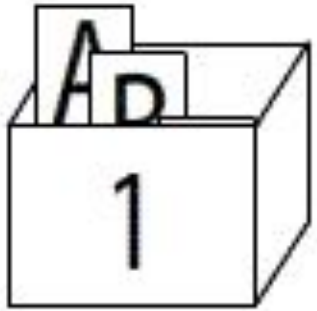
(Background)
Typical Flashcard study

Frontside
e.g., L1 word/phrase prompt

Backside
e.g., L2 word/phrase answer

Interleaved Spaced Repetition Study

(Leitner System or Box system, 1972)

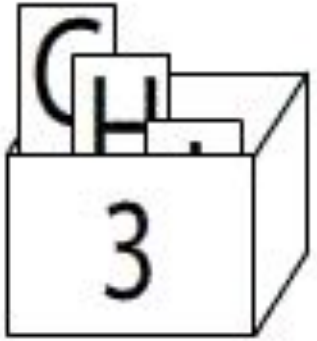


Daily

Meaning

Weekly

Form



Monthly

Use

*Simplified schedule example

If 3 groups of students only have 25 minutes to study new words/ phrases within 9 days, which group will perform best on post-tests?

A →

B →

Table 1. Typical Comparative Example of Expanded, Uniform, and Massed Algorithms

Main Algorithm Types & Intervals	Initial Study	Interval ①	Interval ②	Interval ③	Interval ④
"Expanded" (x type) (~12h start → x 2)	day 1 (start point)	day 1 or 2 (~12 hours)	day 3 (1 day)	day 5 (2 days)	day 9 (4 days)
"Uniform" (same) (→ every 2 days)	day 1 (start point)	day 3 (2 days)	day 5 (2 days)	day 7 (2 days)	day 9 (2 days)
"Massed learning" or (cramming)	(Total study time compressed into a single session) E.g. If a study session lasts 5 minutes: 5 consecutive sessions x 5 = 25 minutes total.				

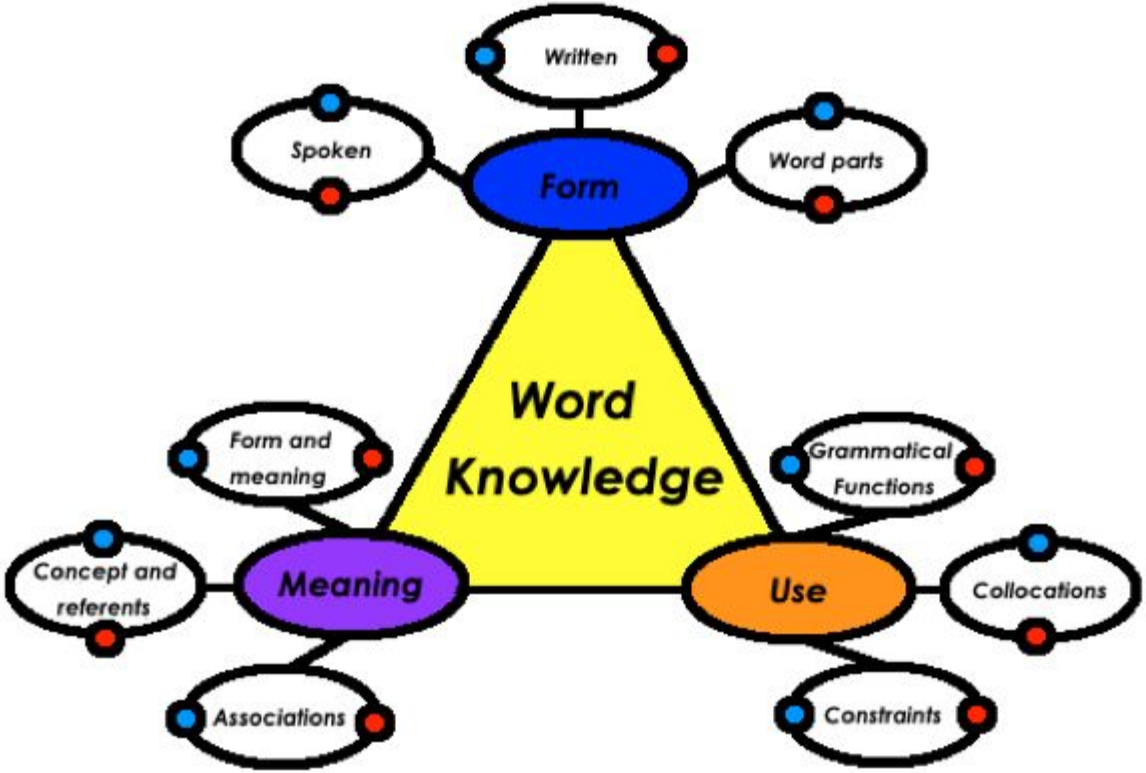
There are actually multiple types of "Expanded Algorithms", Perhaps it would be interesting to compare these in future studies

(Table 2) Schedule Example for Comparison between (+, x and a^b) Expanded Algorithms

Factor of 2 (5 Intervals)	Initial Study	Interval ①	Interval ②	Interval ③	Interval ④	Interval ⑤
"Expanded" (+ type) (previous# → + 2 days)	day 1 (start point)	day 3 (2 days)	day 7 (4 days)	day 13 (6 days)	day 21 (8 days)	day 31 (10 days)
"Expanded" (x type) (→ x 2)	day 1 (start point)	day 1 (later)	day 3 (2 days)	day 7 (4 days)	day 15 (8 days)	day 31 (16 days)
"Expanded" (a^b type) (E.g. → ~19sec$^{(\#)}$)*	day 1 (start point)	day 1 (19 secs)	day 1 (6 mins)	day 1 (2 hours)	day 3 (36 hours)	~day 31 (~28½ days)

*the more precise a^b number here was 18.9 seconds

The Molecular Level of "Word Knowledge"



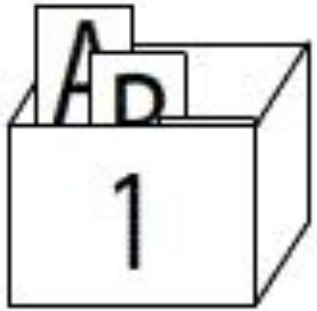
= Receptive knowledge

= Productive knowledge

What is involved in "word knowledge" (Nation, 2001)

Interleaved Spaced Repetition Study

(Leitner System or Box system, 1972)

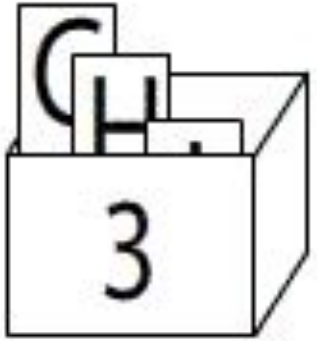


Daily

Meaning

Weekly

Form



Monthly

Use

*Simplified schedule example

Spaced-Interleaved Task Examples and Interval Breakdown for Indirect Spaced Repetition Software/System (ISRS)

Tier Q# level	Flow L1 = native language L2 = second language	Task Type	Task/Interval Route : ↓ when recalled/answered successfully ↻ or ← when recalled/answered unsuccessfully (cooldown timer before next review, h = hour, d = day)		
Ⓜeaning Q#1 word or phrase	L2 audio to L1 recall	Recall Check	↻ Session **1** (initial) ↓	← Session **7** (6d) ↓	← Session **13** (162d) ↓
Ⓜeaning Q#2 word or phrase	L1 word/phrase to L2 recall	Recall Check	↻ Session **2** (8h) ↓	← Session **8** (9d) ↓	← Session **14** (243d) ↓
Ⓕorm Q#1 word or phrase	L2 audio to L2 word/phrase	Spelling	↻ Session **3** (16h) ↓	← Session **9** (18d) ↓	← Session **15** (486d) ↓
Ⓕorm Q#2 sentence	L2 (blank) to L2 sentence	Fill-in-the-blank	↻ Session **4** (1d) ↓	← Session **10** (27d) ↓	← Session **16** (729d) ↓
Ⓤse Q#1 sentence	L2 sentence to L1 sentence	Writing	↻ Session **5** (2d) ↓	← Session **11** (54d) ↓	← Session **17** (1458d) ↓
Ⓤse Q#2 sentence	L1 sentence to L2 sentence	Writing	↻ Session **6** (3d) ↓	← Session **12** (81d) ↓	← Session **18** (2187d) **end**
(Optional)* Q#7 Text	Reading and Listening (L2 to L2)	(Voiced) Reading		↳ back to top ↑	↳ back to top ↑ or end (option)

*For inceased effectiveness, ISRS can be combined with a fluency-building (voiced) reading task For example, studying a set of word items, which compose a text could trigger such an activity.

Interleaved Spaced Repetition Software (ISRS)

Demonstration Video & User Feedback

Study

Think of the meaning (translate)

图表; 图式; 图

See answer

RQ1:

What are the participants' impressions and thoughts related to ISRS?

Software Satisfaction, Likert Mean/SD & Comments

1= Very low; 5= Very high (n = 57)

Software (ease of use) = 3.70 (1.03)

Software (interest) = 3.32 (1.14)

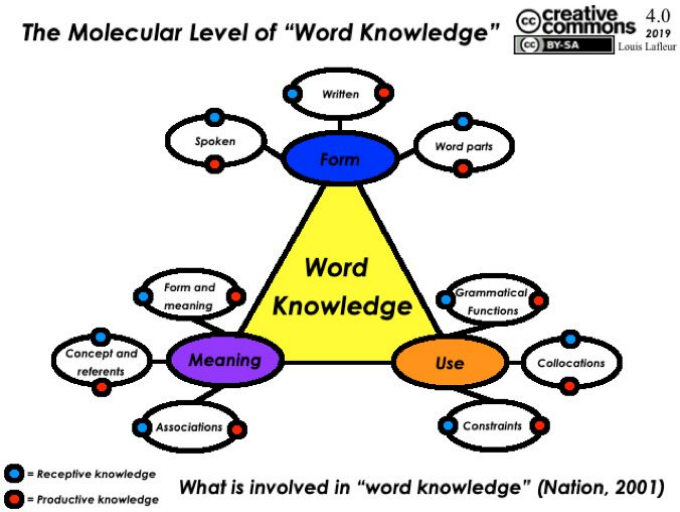
Software (usefulness) = 3.84 (0.90)

"I could use eigomemo easily, and I had a very wonderful time studying while commuting on the train. (P#50)"

"Thanks to the various question types it was easy to study [with eigomemo], but the smartphone version had some bugs. (P#14)"

"The [vocabulary study] content was a little difficult. (P#46)"

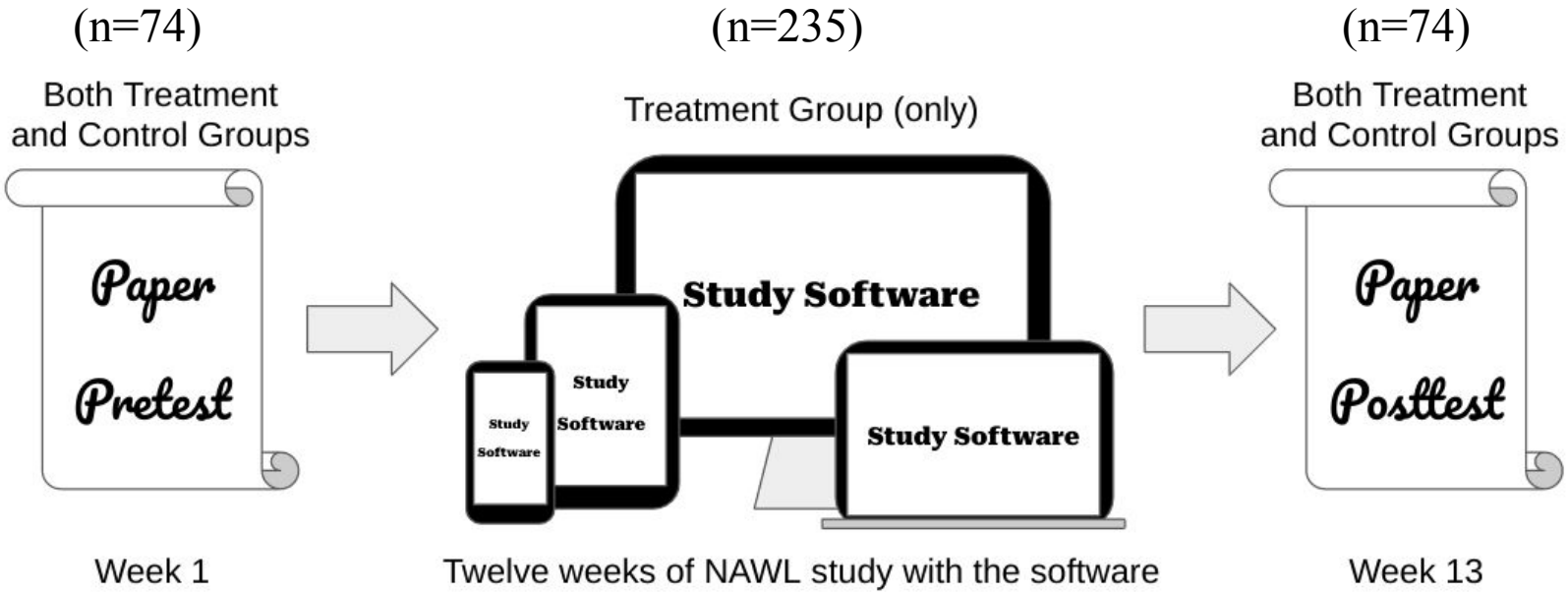
Research Questions



RQ2: What aspects of word knowledge are more likely to be known?

RQ3: What aspects of word knowledge are acquired with/without the treatment software?

Methodology



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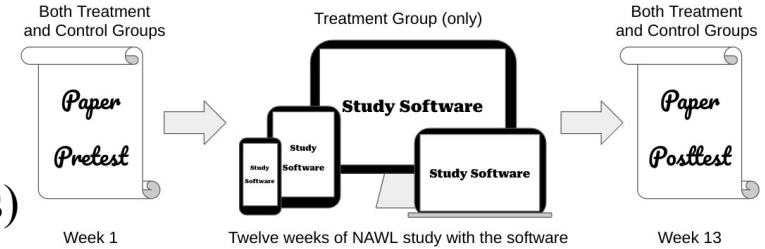

k = 117 (39 selected NAWL word items x 3 question types)

Table 4. Pre/Posttest Sections and Task Flow

Test sections	Task flow	Similar Test Format
(1) "Meaning" Listening Recall	After listening to a sentence and target word audio in English, the participant was asked to translate the target word in Japanese.	(McLean et al., 2021) Spoken Receptive Meaning-Recall /Listening meaning-recall
(2) "Form" Dictation Recall	After listening to the target word audio in English, the participant was asked to write its basic/dictionary form in English.	(Cheng & Matthews, 2018) Testing productive / phonological (ProPhon) vocabulary knowledge
(3) "Use" Listening Recall	After listening to the sentence audio in English of the target word, the participant was asked to write its translation in Japanese.	None, but inspired by Nation's (2001) suggestion to enable a more "in-depth" learning/testing of vocabulary to assure the correct "use" of the words.

RQ2: What aspects of word knowledge are more likely to be known?

RQ3: What aspects of word knowledge are acquired with/without the treatment software?

Table 12. ISRS eNAWL word study effect according to Pre/Posttest Score Results

Group n =	Test	**"Meaning"** test score Median % (IQR %)	**"Form"** test score Median % (IQR %)	**"Use"** test score Median % (IQR %)	**Total** test score Median % (IQR %)
Group 0 n=10	Pretest	28.75% (25.00%)	32.50% (25.00%)	13.75% (29.38%)	24.17% (30.62%)
	Posttest	35.00% (30.00%)	42.50% (21.25%)	21.25% (16.15%)	33.75% (26.67%)
		+6.25% (+5.00%)	+10.00% (-3.75%)	+7.50% (-13.23%)	+9.58% (-3.95%)
		+21.74% relative. diff.	+30.77% relative. diff.	+54.55% relative. diff.	+39.64% relative. diff.
Group 1 n=64	Pretest	24.34% (19.21%)	20.53% (21.05%)	13.16% (21.78%)	17.98% (19.82%)
	Posttest	41.05% (24.61%)	35.92% (32.96%)	26.32% (32.53%)	31.58% (29.38%)
		+16.71% (+5.40%)	+15.39% (+11.91%)	+13.16% (+10.75%)	+13.60% (+9.56%)
		+68.65% relative dif.	+74.96% relative dif.	+100.00% relative dif.	+75.64% relative dif.
Mann-Whitney		U = 543.000	U = 397.000	U = 514.500	U = 515.500
p value		p = <.001	p = .222	p = .002	p = .002
z-derived r		r = .411	r = .142	r = .359	r = .360

Note. Group 0= control group; Group 1= treatment group.

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Leitner system animation (gif), Zirguezi, CC0 1.0 Public Domain, retrieved on 23rd September 2019 https://en.wikipedia.org/wiki/Leitner_system#/media/File:Leitner_system_animation.gif

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