USING FLUENCY TRAINING TO ENHANCE THE CONJUGATION OF SPANISH VERBS

by

Emily Smedlund

A Thesis submitted in

Partial Fulfillment of the

Requirements for the Degree of

Master of Science

in Psychology

at

The University of Wisconsin-Milwaukee

August 2014

ABSTRACT
USING FLUENCY TRAINING TO ENHANCE
THE CONJUGATION OF SPANISH VERBS

by

Emily Smedlund

The University of Wisconsin Milwaukee, 2014
Under the Supervision of Professor Marshall Dermer

This study explored whether a treatment package that included fluency training, Precision Teaching, multiple discrimination, matching to sample, and cumulative practice procedures could teach students to correctly translate noun clauses such as "April cried" from English to Spanish and correctly conjugate the Spanish verb in the clauses even though the conjugation had not been directly trained. The verbs were in the past tense (preterit) and drawn from three classes such that verb inflection in Spanish was identical for verbs within a class and with only a few exceptions different for verbs from different classes. Three students who could not correctly inflect these verbs used special software for 20 min daily on their own and came to the laboratory twice weekly to verify their training. Multiple discrimination procedures taught translation from English to Spanish of nouns and verbs as well as the conjugation of two members of each verb class. Matching to sample procedures established the three verb classes. The major issue was transfer: When participants translated, could they conjugate the Spanish verbs whose conjugations had not been directly trained? Three transfer tests were constructed. Each test contained English clauses that when translated required Spanish verbs from one class. An additional test included clauses from all the tests. These training procedures and battery of tests were arranged to form, at the level of each participant, a multiple

probe design replicated across verb classes. The treatment package was effective for one participant who came to fluently translate and conjugate at rates comparable to those of an experience bilingual speaker. This outcome was not replicated with the other two participants. These failures to replicate were discussed and suggestions for future research were presented.

Dedication

For his generous support I thank my advisor Dr. Marshall Dermer who helped me throughout this project. I also thank Alex Carlson, Megan Bartelt, and Carolina Rodriguez for their assistance. I am especially grateful to John and Lynn Schiek for a project award to pay participants. I also thank my employer and mentor Dr. Jeff Crisco for helping me apply what I have learned in my graduate studies and encouraging me to continue studies in applied behavior analysis. I thank the children with autism in my life who have made my work meaningful. I am especially grateful to my loving family and for the support of my husband Dr. Michael Tomkowiak whose help was crucial for completing this project.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Using Fluency Training to Enhance the Conjugation of Spanish Verbs

Native speakers of English apparently have considerable trouble mastering second languages (e.g., Stein, 2003). Language learning can be difficult because various aspects of a language frequently change irregularly. Such changes are often mastered when an English speaker is forced to live among people who only speak the second language. But such immersion is often impractical.

An alternative to immersion is to assume that language can be analyzed into components, that these components can be taught, and that these components can combine to form composites. Although such a bottom-up strategy uses practice drills (e.g., Pimsleur, 1960) and has been criticized (e.g., Valdman, 1975, p. 354), behavior analysts have had considerable success with this strategy (see, e.g., Cooper, Heron, & Heward, 2007; Skinner, 1957; Sulzer-Azaroff & Mayer, 1991).

Their success may be due to having augmented drills in important ways. First, although students practice a skill until they achieve accuracy; they are also required to practice until they achieve fluency. Fluency is defined as reaching an aim based, for example on the correct and incorrect responses per minute of an expert. Alternatively aims can be based on rates that promote retention (fluency is maintained long after training), endurance (fluency is maintained for long durations and when distracters are present), and application (component behaviors can easily be combined to form composites) (Binder, 1996, 2004; Johnson & Layng, 1996; Kubina & Wolfe, 2005).

Fluency training is often combined with Precision Teaching. For this procedure test sessions are conducted daily and rates of correct and incorrect responses per minute

are plotted on a special graph, the Standard Celeration Chart, to ascertain whether learning is occurring. If these graphs do not reveal learning then training procedures are revised (see Eshleman, 2002).

Once a student is fluent with component behaviors, it is possible that the composites will emerge without additional training. This emergence is called contingency adduction (Johnson & Layng, 1996). Otherwise students receive application training, which merges the components into the higher-level composites (Johnson & Layng, 1994; Johnson & Street, 2004).

Another way drills have been augmented is cumulative practice (Mayfield & Chase, 2002). Once a student has mastered or become fluent with Unit I and Unit I+1 the student must next complete a cumulative unit containing all the items from the previous units before moving on. Other important differences between drill and fluency training are nicely summarized by Eshleman (2000a).

Although using behavior analysis to promote second language learning has been proposed (e.g. Sundberg, 1991) only a few studies have been conducted. For example, symmetry has been explored regarding learning to type out a word in one language on seeing the printed, corresponding word in a second language (Polson, Grabavac, & Parsons, 1997; Polson & Parsons 2000), as has the role of contextual stimuli in controlling responding in a second language (Washio & Houmanfar, 2007). The effects of learning negation in a second language on negation in a first language have been explored with implications for instructional procedures (Madrid & Torres, 1986). Although Precision Teaching has been frequently used to teach first languages (Cihon,

2007), it apparently has not been frequently used to teach second languages. This is somewhat ironic as fluency is an objective of second language instruction (e.g., Gatbonton & Segalowitz, 2005).

At least three studies have used fluency training or Precision Teaching to enhance second language related responding. In one study, students typed a definition on seeing an English morpheme derived from Greek. On achieving a fluency aim, they were trained to respond symmetrically: on seeing the typed definition, they typed the corresponding morpheme (Harrington, Hunt, & Israel, 2007).

Most related to second language learning is Calkin's (1996) work. Calkin augmented her Russian coursework and other instructional material with fluency training. Behaviors that she trained included reading and vocabulary building, declining nouns and adjectives, and conjugating verbs. She used the procedure known as "Say All Fast a Minute Every Day Shuffled" (SAFMEDS, see Eshleman, 2000b) to achieve fluency and Precision Teaching to tailor her instructional methods to her performances.

More recently, Kirsch (2006) analyzed the behavior of declining German articles. Based on her analysis, she constructed training units that included declining articles in simple clauses and phrases. Her participants worked on a unit until achieving a fluency aim and plotted their rates of corrects and incorrects daily as per Precision Teaching.

An article's declension depends on its "case" which is a function of a noun's grammatical role. For example, a noun that is the subject of a verb is in the nominative case, but there are three other cases. Particularly confusing is that when a noun is the object of a preposition its case depends on the preposition. Fortunately, however, the

prepositions are members of classes. So to establish these classes Kirsch used matching to sample (MTS) procedures (e.g., Green & Saunders, 1998). Later, Kirsch's units trained the declension of articles for the four cases. But she staggered the training of declensions and used a multiple probe design replicated across cases (and therefore declensions) to assess whether training was effective. She composed her tests of transfer from a reserve vocabulary that had appeared in units that had trained translation, gender identification, conjugation, and preposition classes; but had not appeared in the units that had trained declension. Although Kirsch's (2006) results were not definitive, participants' declension of articles generally did improve as per the design.

The present study explored the utility of Kirsch's strategies (2006) for teaching the conjugation of Spanish verbs. Teaching this skill is an old and difficult problem (e.g., Leonard, 1925) because the conjugation of many Spanish verbs is irregular. Fortunately, many verbs are conjugated identically within classes and differently between classes and so can be grouped. Three classes of these verbs, in the preterit, were established using matching to sample (MTS) procedures and later the conjugation of two members of each class was taught. Importantly, training to conjugate the first class of verbs occurred before training to conjugate the second class, and training to conjugate the second class occurred before training to conjugate the third class. By staggering such training, the effects of the training could be assessed via a multiple-probe design.

To assess training effects, a battery of four transfer tests was constructed. All the verbs appearing on three of the tests were members of one of the three classes, but the conjugation of these verbs had never been directly trained. Although the conjugation of these particular verbs had not been directly trained, a student should be able to conjugate

them because of their class membership. The fourth test included verbs from all the tests. Each test was administered individually and timed. The battery was administered twice before any training and re-administered immediately after the conjugation of each verb class was trained. Finally the battery was re-administered one month after training to assess maintenance.

Method

Participants

Three college students who read Spanish correctly and wished to improve their Spanish were recruited. Participants completed a screening test on which they conjugated correctly no more than 25% of the verbs appearing on the transfer test.

Participant 1 was a doctoral student, age 30, for whom English was his first language. He had studied Spanish for three years in high school and had visited Peru. It should be noted that Participant 1 shared a personal relationship with the experimenter and therefore did not receive compensation.

Participant 2 was an undergraduate senior, age 23, for whom Hmong was his first language and English was his second language. He had studied Spanish for 2 years in college.

Participant 3 was an undergraduate senior, age 26, for whom English was his first language. He had studied Spanish for 2 years in high school.

Materials

Vocabulary. Tables 1-3, present the three classes of verbs. For each table, verbs A and B were used directly to train conjugation. The remaining verbs, "transfer verbs," were used to test for transfer. Also trained were translating pronouns and proper nouns from English to Spanish. These proper nouns included: John (*Juan*), Richard (*Ricardo*), William (*Guillermo*), April (*Abril*), Rose (*Rosa*), and Linda (*Linda*). Variations of these nouns and pronouns were combined to construct alternate versions of the form "we" and "they." *Señor* and *señora* were used mark the formal "you" (*usted*).

Table 1

Class 1: Verbs, Stems, Preterit Stem, & Preterit Inflections

ID	Verbs (Training Verbs Boldfaced)	Stems	Preterit Stems	Inflections
A	***saber*** (to know)	*sab-*	*sup-*	
B	***poder*** (to be able to)	*pod-*	*pud-*	
C	*venir* (to come)	*ven-*	*vin-*	I-*e* You (familiar)–*iste*
D	*decir* (to say)	*dec-*	*dij-*	
E	*poner* (to put/place)	*pon-*	*pus-*	He/She/It/ You (formal)-*o*
F	*querer* (to want)	*quer-*	*quis-*	We-*imos*
G	*andar* (to walk)	*and-*	*anduv-*	They/You all (formal) -*ieron*
H	*tener* (to have)	*ten-*	*tuv-*	

Table 2

Class 2: Verbs, Stems, Preterit Stems, & Preterit Inflections

ID	Verbs (Training Verbs Boldfaced)	Stems	Preterit Stems	Inflections
A	***destruir*** (to destroy)	*destru-*	*destru-*	
B	***huir*** (to flee)	*hu-*	*hu-*	
C	*construir* (to build)	*constru-*	*constru-*	I-*í* You-*iste* (familiar) He/She/It/ You (formal) -*yó* We-*imos* They/You all (formal)-*yeron*
D	*incluir* (to include)	*inclu-*	*inclu-*	
E	*contribuir* (to contribute)	*contribu-*	*contribu-*	
F	*influir* (to influence)	*influ-*	*influ-*	
G	*concluir* (to conclude)	*conclu-*	*conclu-*	
H	*substituir* (to substitute)	*substitu-*	*substiu-*	

Table 3

Class 3: Verbs, Stems, Preterit Stems, & Preterit Inflections

ID	Verbs (Training Verbs Boldfaced)	Stems	Preterite Stems	Inflections
A	***mandar*** (to demand)	*mand-*	*mand-*	
B	***luchar*** (to fight)	*luch-*	*luch-*	I-*é* You (familiar)-*aste* He/She/It/ You (formal)-*ó* We-*amos* They/You all (formal)-*aron*
C	*llorar* (to cry)	*llor-*	*llor-*	
D	*llamar* (to call)	*llam-*	*llam-*	
E	*tomar* (to take)	*tom-*	*tom-*	
F	*hablar* (to talk)	*hab-*	*hab-*	
G	*fumar* (to smoke)	*fum-*	*fum-*	
H	*descansar* (to rest)	*descan-*	*descan-*	

Table 4

Verb Inflections Used for Each Class Test (Those not used are struck out.)

Person	Class		
	1	2	3
I	*-e*	*-í*	*-é*
You (familiar)	~~*-iste*~~	*-iste*	*-aste*
He/She/It/ You (formal)	*-o*	*-yó*	*-ó*
We	*-imos*	~~*-imos*~~	*-amos*
They/You all formal	*-ieron*	*-yeron*	*-aron*

Software. A computer program written in Visual Basic® presented training frames. On activating the software, participants specified the location for storing their performances, their alias, and the module and training unit they studied. Participants next chose training modules or units and set session duration as illustrated in Figure 1 and Figure 2 below.

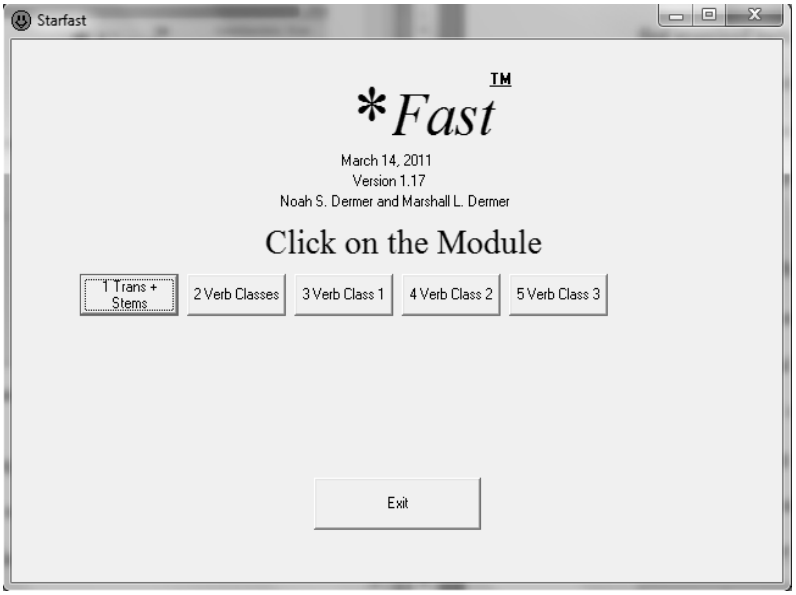


Figure 1. Interface for selecting a module.

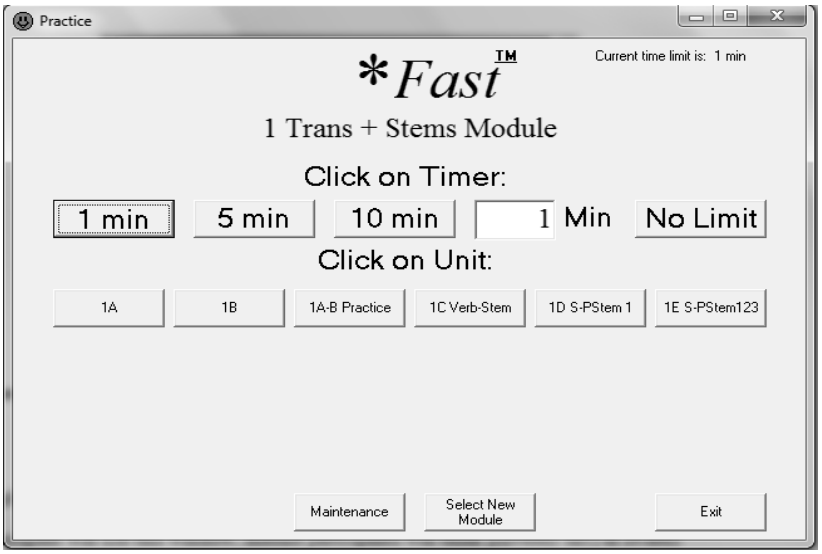


Figure 2. Interface for selecting session duration and a training unit.

The interface for presenting frames is presented in Figure 3. The top window displayed instructions and text. The middle window could display typed responses but was not used; instead participants thought, covertly said, or overtly said their answers. The interface included three buttons. Depressing the Answer Button presented the answer and additional buttons. Depressing the Previous Button presented the previous frame. Depressing the Stop Button stopped the session and produced a screen with summary statistics.

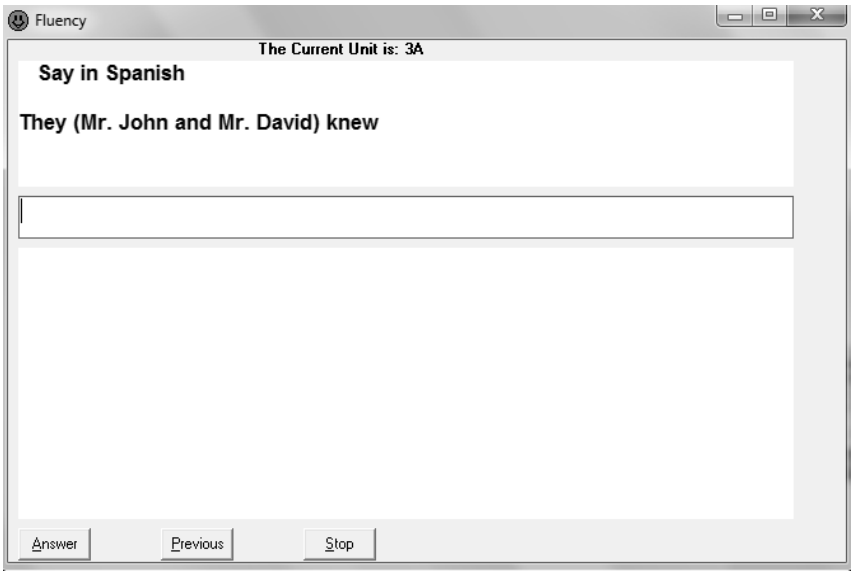


Figure 3. Interface for presenting text (upper window) and buttons for revealing answer, presenting previous frame, and stopping sessions, respectively.

As depicted in Figure 4, after depressing the Answer Button three additional buttons appeared. The Right Button and Wrong Button permitted scoring responses as correct and incorrect, respectively. The Remove Button dropped frames from a practice session. (Participants could restore these frames by depressing the Maintenance Button, depicted in Figure 2.) Scoring a response or removing a frame presented the next frame.

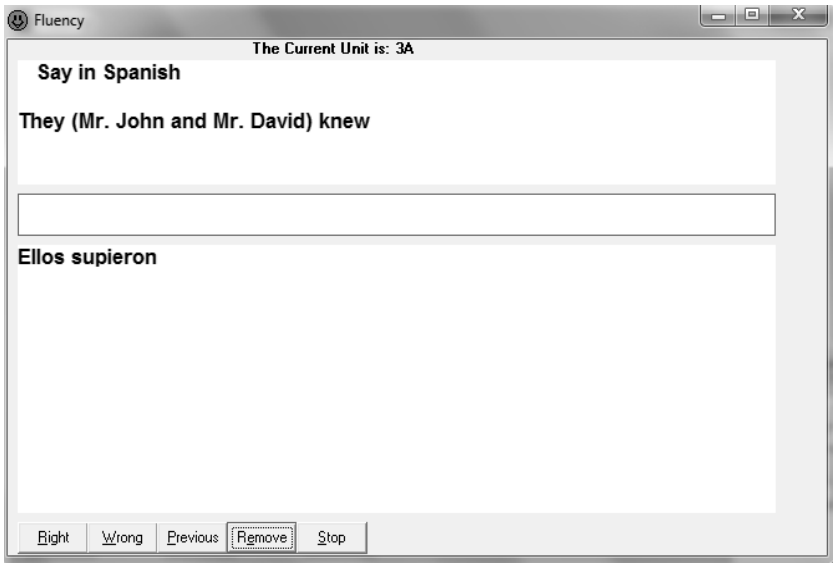


Figure 4. Interface for presenting answer (bottom window) and buttons for scoring answers correct and incorrect, presenting a previous frame, removing a frame, and stopping session, respectively.

When a session timed out or the participant depressed the Stop Button the summary screen appeared, as depicted in Figure 5. The screen displayed (a) the unit's name, (b) the aim (number of corrects per minute; incorrects were assumed to be 0/min), (c) the number of frames in a unit, (d) the number of correct responses per minute, (d) the number of incorrect responses per minute, and (e) the session's duration. The software recorded these data and the session's date and time in ASCII and encrypted formats.

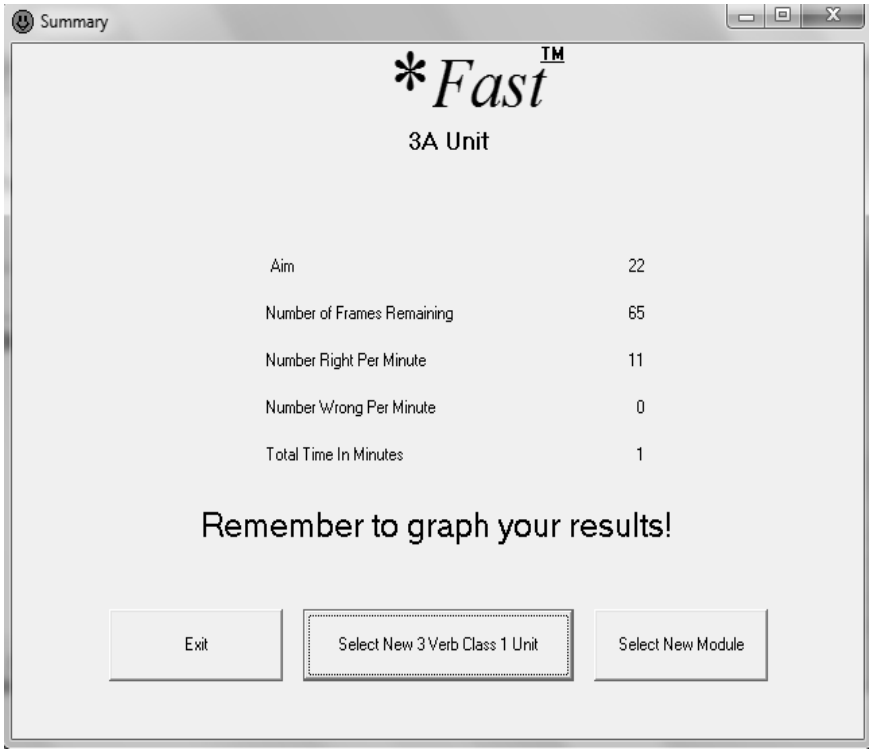


Figure 5. Summary screen showing aim, number of frames remaining for training, number of corrects and incorrects per minute and total training time.

Aims, Modules, and Training Units

Aims. The aims for seeing and saying were based on the best 1-min performances that a bilingual speaker had achieved. Incorrect responses were not accepted.

Modules. The software included five modules. Each module included units and each unit presented frames in random order. In outline, the software first provided practice in translating nouns, pronouns, and verbs. Next it provided practice in MTS problems that presumably would establish three verb classes based the verbs' inflections. Next, it provided practice in conjugating Class 1 verbs, then Class 2 verbs, and finally Class 3 verbs. Conjugation was presumably established by providing practice in conjugating the two training verbs (Verb A and Verb B in Tables 1-3) in the context of a noun clause as illustrated in Figure 3.

Module 1 is outlined in Table 5. For each frame the participant saw an English word and responded in Spanish. After the participant depressed the Answer Button, the software presented the correct Spanish and the participant scored the response. The module ended with a unit that contained all the frames from prior units and so provided cumulative practice.

Table 5

Training Units and Aims for Module 1: Translations and Verb Stems

Unit	Description	Aim Corrects: Incorrects /Min
1A	English nouns and pronouns to Spanish	30:0
1B	English verbs to Spanish infinitive	30:0
1AB	Cumulative practice Unit 1A-1B	30:0
1C	In Spanish, verbs to verb stems	40:0
1D	Spanish present to preterit Class 1 verb (stem changes)	40:0
1E	Spanish present to preterit all verb stems	40:0

Module 2 is outlined in Table 6. Unit 2A through Unit 2H sought to establish three verb classes using MTS procedures. Figure 6 depicts a frame from Unit 2A where the sample stimulus is “2 Past” and the comparison stimuli are three verb roots, one from each class.

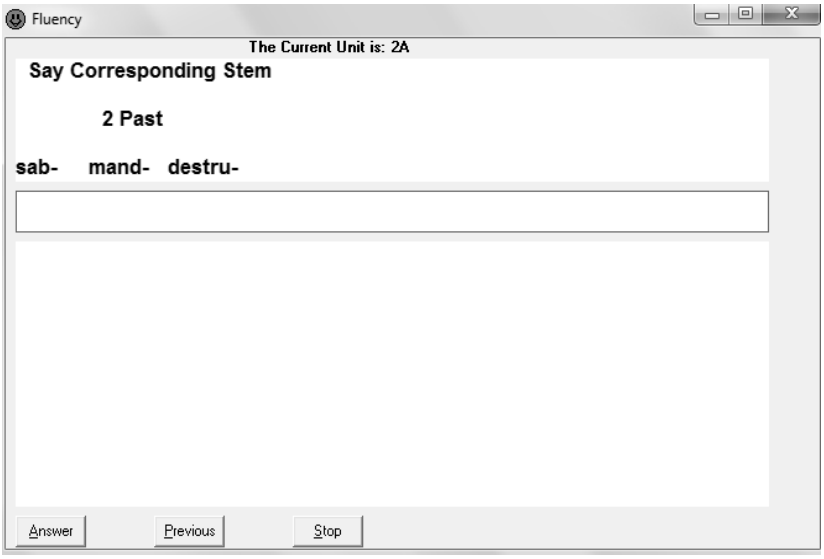


Figure 6. From Module 2, a frame requiring matching to sample.

When the Answer button was pressed *destru-* the corresponding root appeared. Each frame included one of the sample stimuli ("1 Past," "2 Past," and "3 Past") and all the comparison verb roots noted in Tables 1-3, line A: *sab-*, *destru-*, *mand-* . Additionally, the comparison stimuli rotated randomly through the three positions: left, middle, and right.

Units 2B through Unit 2H were analogous to Unit 2A except the comparison stimuli were the corresponding verb roots depicted in Tables 1-3.

Unit 2AB, a cumulative practice unit, contained all frames from Units 2A and 2B. Similarly Unit 2AC contained all frames from Unit 2A through Unit 2C. The remaining cumulative practice units were analogously constructed. Module 2 ended with Unit 1AB and Unit 1E, the cumulative practice units from Module 1 (see Table 6).

Table 6

Training Units and Aims for Module 2: Using MTS Procedures to Establish the Three Classes of Verbs Where the Sample Stimuli are "1 Past," "2 Past," and "3 Past" and Roots are from Tables 1-3

Unit	Description	Aim Corrects: Incorrects /Min
2A	Roots from row A	45:0
2B	Roots from row B	45:0
2AB	Cumulative practice Units 2A-2B	45:0
2C	Roots from row C	45:0
2AC	Cumulative practice Units 2A-2C	45:0
2D	Roots from row D	45:0
2AD	Cumulative practice Units 2A-2D	45:0
2E	Roots from Row E	45:0
2AE	Cumulative practice Units 2A-2E	45:0
2F	Roots from row F	45:0
2AF	Cumulative practice Units 2A-2F	45:0
2G	Roots from row G	45:0
2AG	Cumulative practice Units 2A-2G	45:0
2H	Roots from Row H	45:0
2AH	Cumulative practice Units 2A-2H	45:0
2I (1AB)	Cumulative practice Unit 1A-1B	30:0
2J (1E)	Spanish present to preterit all verb stems	40:0

Module 3, outlined in Table 7, provided practice in conjugating Class 1's two training verbs. Participants saw noun clauses in English that included verbs in the preterit and attempted to say the corresponding Spanish. In Unit 3A and Unit 3B, for example, on seeing "I knew," the participant was to respond with *Yo supe* (see Figure 7).

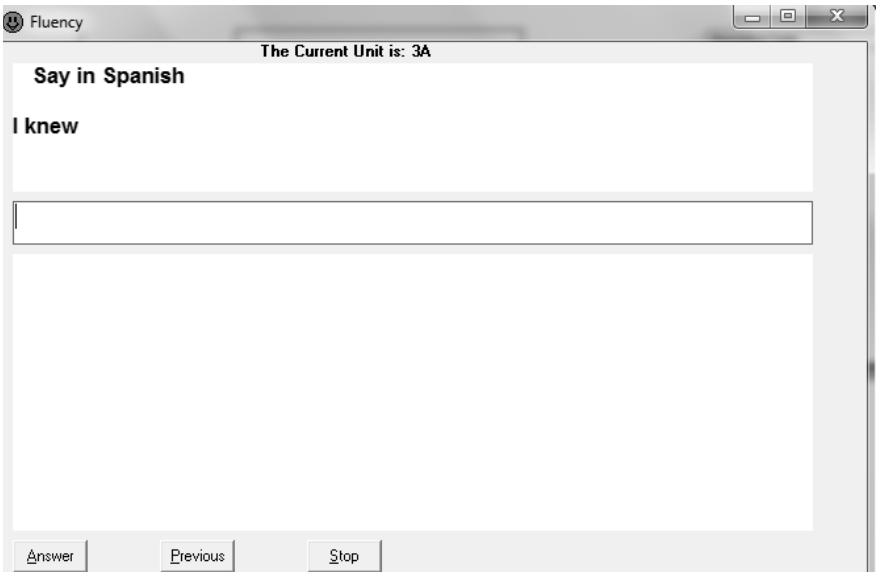


Figure 7. From Module 3, a noun clause requiring translation.

Yo supe appeared when the participant depressed the Answer Button. In these units, conjugation training was only provided for the training verbs as noted in the top two rows of Table 1. In Unit 3A, participants practiced conjugating *saber*. In Unit 3B participants practiced conjugating *poder*. These units were combined in Unit 3AB, to provide cumulative practice.

In Module 3 participants practiced: (a) conjugating the two Class 1 training verbs in Units 3A, 3B, and 3AB; and (b) completed cumulative practice in Units 3D and 3E with the final cumulative units from Modules 1 and 2.

Table 7

Training Units and Aims for Module 3: Practice Conjugating Class 1 Verbs Plus Seeing Infinitive and Saying Preterit Root Plus Cumulative Practice

Unit	Description	Aim Corrects: Incorrects /Min
3A	Conjugation training Class 1 Verb A	22:0
3B	Conjugation training Class 1 Verb B	22:0
3AB	Cumulative practice Conjugation Class 1 Verb A-B	22:0
3C (1E)	Spanish present to preterit all verb stems	40:0
3D (1AB)	Cumulative practice Unit 1A-1B	30:0
3E (2A-H)	Cumulative practice Units 2A-2H	45:0

In Module 4, outlined in Table 8, and Module 5, outlined in Table 9, participants similarly practiced conjugating the preterit for Class 2 and Class 3 training verbs, respectively. These modules were structured like Module 3, with each new module ending with units providing cumulative practice from previous modules.

Table 8

Training Units and Aims for Module 3: Practice Conjugating Class 2 Verbs Plus Seeing Infinitive and Saying Preterit Root Plus Cumulative Practice

Unit	Description	Aim Corrects: Incorrects /Min
4A	Conjugation training Class 2 Verb A	22:0
4B	Conjugation training Class 2 Verb B	22:0
4AB	Cumulative practice Conjugation Class 2 Verb A-B	22:0
4C	Cumulative practice Conjugation Class 1 Verb A-B	22:0
4D (1E)	Spanish present to preterit all verb stems	40:0
4E (1AB)	Cumulative practice Unit 1A-1B	30:0
4F (2A-H)	Cumulative practice Units 2A-2H	45:0

Table 9

Training Units and Aims for Module 3: Practice Conjugating Class 3 Verbs Plus Seeing Infinitive and Saying Preterit Root Plus Cumulative Practice

Unit	Description	Aim Corrects: Incorrects /Min
5A	Conjugation training Class 3 Verb A	22:0
5B	Conjugation training Class 3 Verb B	22:0
5AB	Cumulative practice Conjugation Class 3 Verb A-B	22:0
5C	Cumulative practice Class 1-2 Verb A-B conjugations	22:0
5D (1E)	Spanish present to preterit all verb stems	40:0
5E (1AB)	Cumulative practice Unit 1A-1B	30:0
5F (2A-H)	Cumulative practice Units 2A-2H	45:0

Data Recording Material. Data from the summary screens were transcribed by participants to log sheets (see Appendix A). Participants then plotted rates of corrects and incorrects on a 4-cycle log scale as a function of minutes of training in a unit (Cumulative Chart, see Appendix B).

Recruitment Flyer. A recruitment flyer was distributed among campus buildings and on list-servers online (see Appendix D).

Background Survey. Participants answered questions regarding their experiences with Spanish (see Appendix E).

Tests.

Qualification Test. This test screened students for the skills we planned to train. The test was identical to the Mixed Test (described below), except it only required students to specify the Spanish inflection. For example, an item on the qualification test

might be “I influenced Yo influ___” with the student only asked to specify the ending as in “_í_”. Participants had 5.5 min to complete this test (see Appendix E).

Test Battery. In overview, the battery included four tests: three class tests, each 2 min in duration, which were administered in random order, and a mixed test, 5 min in duration, always administered last. Each class test corresponded to one of the verb classes. The mixed test contained items sampled from each class test.

The tests were constructed as follows. The items on each class tests included noun clauses, like the training items, but only the transfer verbs were used. Regarding the verbs, they were randomly sampled without replacement from the six transfer verbs. Regarding persons (1st, 2nd, etc.), they were randomly sampled without replacement from the unique forms noted in Table 4. So, as Table 4 indicates, some persons were not used, to render the three class tests independent. For example, “You said” (Class 1: decir: Usted dij + iste) is inflected as “You fled” (Class 2: huir: Usted hu+ iste). Consequently, the tests for Class 1 and Class 2 included blocks of four items, and the test for Class 3 included blocks of five items with persons randomly sampled without replacement. Regarding the grammatical subjects of the verbs, they agreed with the verbs and were randomly sampled without replacement from the list of pronouns and proper nouns noted above in “Vocabulary.” The items on the mixed test included items sampled without replacement from the items on the class tests. For each block of three items, one item came from each class test.

Experimental Design

A multiple probe design replicated over verb classes was used. The test battery was administered twice before any training to establish "bench marks." Then it was administered after practice conjugating Class 1verbs, next after practice conjugating Class 2 verbs, and next after practice conjugating Class 3 verbs. Finally, the battery was administered about one month after training to assess maintenance.

Procedure

Interested students were invited to the laboratory where the entire study was briefly described. Students next read the consent instructions for the qualification test. Students were asked to complete all test items. If they could not inflect a verb, they were asked to place an “X” in the space provided. The test was immediately scored and students who conjugated 25% or fewer of the items attempted were invited to participate and given the informed consent form for the main study. All students qualified.

At a second meeting the consent form was reviewed, the signed form collected, and the goals and methods of the research were further discussed. Also participants completed the Background Survey. At this meeting's end, participants completed the first test battery.

At the next meeting, participants were shown how to install and use the software. Each participant was shown, with the software, how to (a) choose a module, (b) specify a training session’s duration, (c) select a unit, (d) respond appropriately (either overtly [say] or covertly [think]), (e) score responses, (f) remove frames from a unit, and (g) transcribe information from the Summary Screen. Participants were taught to record data

on the logs and chart performances on the cumulative chart (for details see Kirsch, Schwartz, & Dermer, 2008).

Participants were asked first to achieve accuracy and then fluency. To meet these objectives, participants were asked to train for 20 min daily and choose session durations. They might, for example, conduct one, 20-min session or four, 5-min sessions or 20, 1-min sessions. They were also asked to complete a 1-min session at the end of each training day. For each session they were asked to transcribe the data from the summary screen to their log sheets and chart their rates of correct and incorrect responses on the cumulative chart as a function of the cumulative minutes they had trained within a unit. Participants were instructed to train with each unit in succession. They were told not to move to the next unit until they had achieved a unit's aim for three consecutive, 1-min tests (probes) across a minimum of two days. Participants were instructed to conduct these three tests as they approached mastery of a unit. Additionally, participants were asked to pause training after completing each of Modules 3, 4, and 5 for re-administration of the test battery. Given these instructions, participants began training.

To verify training, participants met with the researcher twice a week. At these verification meetings, the participants and the researcher reviewed the participant's logs and chart and offered recommendations for training, for example, working on accuracy, temporarily removing frames, and adjusting the length and distribution of training sessions. Also at this time, the researcher conducted a 1-min session with the participant's most recently completed unit to verify scoring accuracy. Additionally, if the participant had recently completed a module, then the test battery was administered.

Dependent variable. For each test, the experimenter read the instructions as the participant followed along (See Appendix G). Participants were asked to translate each noun clause though only verb use was scored.

Inter-Observer Agreement. An additional observer, blind to this study, independently scored 30% of the tests. A single measure of inter-observer agreement (IOA) was calculated for all responses that measured occurrence:nonoccurrence reliability (Bailey & Burch, 2002). Inter-observer agreement was calculated by dividing the number of agreements by the sum of the number of agreements plus the number of disagreements and multiplying by 100%. For Participants 1-3, the average IOA was 99%, 99%, and 91%, respectively.

Results

Participant 1

Training. Participant 1 generally followed the procedure but there were minor departures. These included an occasional delay between mastery of a module and completing the battery.

Over all units, Participant 1 trained for slightly more than 10 hr. He trained at least 5 days a week for about 20 min daily. His training sessions were always 1 min and he mastered a unit on average after 14 min. Table 10 summarizes Participant 1's performances for each unit in terms of (a) initial corrects per minute, (b) final incorrects per minute, (c) the celeration for corrects between initial and final sessions, (d) initial incorrects per minute, (e) final incorrects per minute, (f) the celeration (when applicable) for incorrects between initial and final sessions, and (g) minutes of training in unit. Table

10 indicates that for each unit Participant 1 achieved accuracy, as his final rate of incorrects was 0/min. Also, for each unit, Participant 1 achieved fluency as his final rate of corrects exceeded each unit's aim.

Table 10

Summary of Participant 1's Performances for each Unit in Terms of: Unit, Aim, Initial Corrects per minute, Final Corrects per minute, Celeration, Initial Incorrects per minute, Final Incorrects per minute, Celeration, and Minutes of Training in Unit

Unit	Aim Corrects: Incorrects /Min	Initial Corrects /Min	Final Corrects /Min	Cel	Initial Incorrects /Min	Final Incorrects /Min	Cel	Training Min
1A	30:0	17	34	2.0	.6	0	0	126
1B	30:0	3	34	11.3	3	0	0	23
1AB	30:0	30	37	1.2	1	0	0	21
1C	40:0	15	52	3.5	1	0	0	19
1D	40:0	0	44		7	0	0	24
1E	40:0	34	60	1.8	0	0	0	8
2A	45:0	1	54	54.0	3	0	0	39
2B	45:0	31	51	1.6	2	0	0	12
2AB	45:0	34	46	1.4	0	0	0	85
2C	45:0	36	58	1.6	0	0	0	7
2AC	45:0	40	45	1.1	0	0	0	18
2D	45:0	37	50	1.4	2	0	0	7
2AD	45:0	43	48	1.1	0	0	0	6
2E	45:0	42	51	1.2	2	0	0	5
2AE	45:0	39	48	1.2	0	0	0	6
2F	45:0	30	48	1.6	2	0	0	4
2AF	45:0	46	47	1.0	0	0	0	8
2G	45:0	28	52	1.9	3	0	0	4
2AG	45:0	45	45	1.0	0	0	0	5
2H	45:0	38	57	1.5	3	0	0	5
2AH	45:0	47	46	.98	0	0	0	6
2I (1AB)	30:0	49	46	.94	0	0	0	4
2J (1E)	40:0	12	57	4.8	6	0	0	6
3A	22:0	2	23	11.5	4	0	0	12
3B	22:0	8	27	3.4	2	0	0	7
3AB	22:0	13	21	1.6	2	0	0	52
3C (1E)	40:0	49	64	1.3	0	0	0	8
3D (1AB)	30:0	42	37		0	0	0	7
3E (2A-H)	45:0	37	47	1.3	0	0	0	9
4A	22:0	5	24	4.8	3	0	0	6
4B	22:0	4	22	5.5	6	0	0	5
4AB	22:0	19	26	1.4	0	0	0	8
4C	22:0	15	26	1.7	0	0	0	4
4D (1E)	40:0	66	77	1.2	0	0	0	3
4E (1AB)	30:0	43	41		0	0	0	3
4F (2A-H)	45:0	45	47	1.0	0	0	0	3
5A	22:0	7	30	4.3	5	0	0	4
5B	22:0	4	31	6.2	0	0	0	4
5AB	22:0	24	25	1.0	1	0	0	6
5C	22:0	18	23	1.3	0	0	0	6
5D (1E)	40:0	66	68	1.0	0	0	0	4
5E (1AB)	30:0	46	50	1.1	0	0	0	3
5F (2A-H)	45:0	47	48	1.0	0	0	0	3

Table 10 indicates that Participant 1 often became more proficient when completing conceptually equivalent units as training progressed. The A units are conceptually equivalent across Modules 3-5. The times for Unit 3A, 4A, and 5A were 12, 6, and 4 min, respectively. The B units were also conceptually similar as were the AB units. The times for Unit 3B, 4B, and 5B were 7, 5, and 4 min, respectively. The times for Unit 3AB, 4AB, and 5AB were 52, 8, and 6 min, respectively.

The same trend was evident within a module when summing the amount of time across the A, B, and AB units. For these units in Module 3, the total time to achieve the aims was 61 min; for Module 4, the total time was 19 min; and for Module 5, the total time was 14 min.

Because Table 10 summarizes Participant 1's performances, a more fined-grain analysis is interesting. Such an analysis is presented in Figure 8 for Module 3 because performances in this module were typical of performances in the other modules. In Figure 8 the record floor is 1 /min (1 divided by session duration in minutes). Rates of corrects per minute are indicated with ●'s and rates of incorrects per minute are indicated with X's, with X's plotted below the record floor for rates of zero. For Participant 1, mastery for units in Module 3 ranged from 5 min to 50 min with the cumulative practice units requiring the most time.

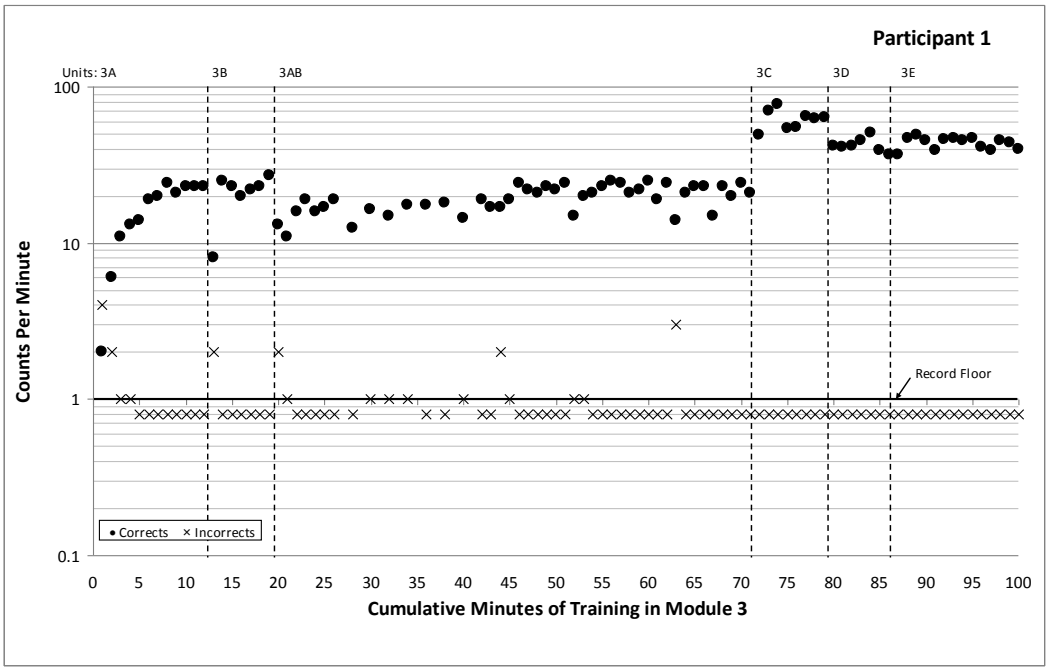


Figure 8. Participant 1's rates of corrects and incorrects for the units in Module 3.

Transfer. As noted earlier, the battery was to be administered twice before any training occurred to establish a benchmark. The third through fifth administrations were after training how to conjugate each verb class to assess training effects. The sixth administration was one month after all training was completed to assess maintenance. This schedule was modified for Participant 1 when after having completed the training for conjugating the Class 1 verbs, Participant 1's accuracy for the Class 1 verbs was zero.

To understand this unexpected outcome, Participant 1 was interviewed. He explained that the instructions dissuaded him from attempting to conjugate the Class 1 verbs because these verbs were not directly trained. With Participant 1's help the instructions were modified from this:

If you don't know the entire translation, then use Spanish for whatever part you may know. Perhaps for "I moved" you know all the Spanish but the ending. Then you might neatly write: Yo mov.

Of course you might not at all know the verb, so you might neatly write: Yo moved.

Do not skip any items. If you do not know any of the Spanish, then just neatly rewrite the item in English: I moved.

to this:

Often, however, you can specify a verb's ending because Spanish verbs fall into classes such that all verbs in a class are conjugated identically. So if you know the endings for one verb in a class and you know that another verb is in that class, you should know the other verb's ending and so you should be able to make an educated guess and write a complete translation:

With these new instructions, Participant 1 completed the battery a second time and the new instructions were used for the remaining administrations of the battery for this and the other participants.

Below the data for all administrations of the battery are presented, but because of the instruction problem visual analysis focuses on the data from when the new instructions were introduced Post C1 b to Follow-up.

Figure 9 depicts rates of correct and incorrect conjugations as a function of the three class tests and the seven administrations of the battery.

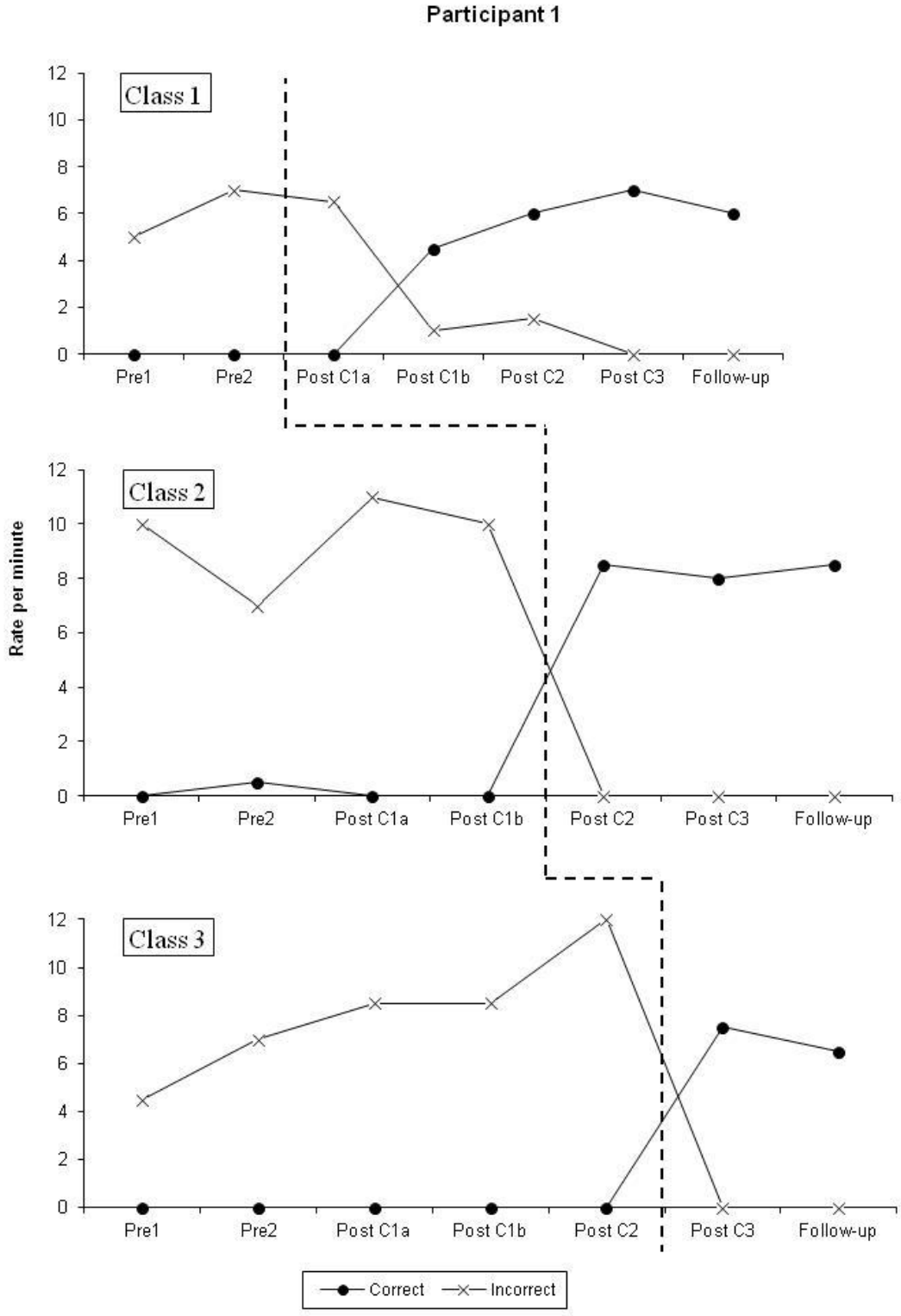


Figure 9. Participant 1's correct ('●') and incorrect ('X') conjugations per minute for each class test when the battery was administered twice before training, after training on Class 1 verbs, after training on Class 2 verbs, and after training on Class 3 verbs.

After training to conjugate Class 1 verbs and with the revised instructions, rates of corrects were 4.5 per min at Post C1b and increased to 6 per min at Follow-up. However, it is not clear whether these high rates are due to training because baseline data for Class 1 verbs are absent. As for incorrects for Class 1 verbs, at Post C1b rates of incorrects were 1 per min and remained low through Follow-up. Again, it is not clear whether these low rates are due to training because baseline data for Class 1 verbs are absent. In summary, the rates are consistent with the training for Class 1 verbs being effective but the excellent performance for these verbs may be due to factors in effect before training the conjugation of Class 1 verbs.

Much clearer, are the outcomes for the remaining classes. For Class 2 verbs rates of corrects were 0 per min before training at Post C1b and increased to 8.5 correct per min after training at Post C2. This high level persisted through Follow-up. Importantly for the Post C1b to Post C2 comparison rates of corrects for Class 3 verbs did not increase. This outcome suggests that the training increased rates of corrects. Now consider rates of incorrects. For Class 2 verbs rates of incorrects were 10 per min before training at Post C1b and decreased to 0 incorrect per min after training at Post C2. This low level persisted through Follow-up. Importantly for the Post C1b to Post C2 comparison, rates of incorrects for Class 3 verbs did not decrease; they increased. Importantly, rates of corrects and incorrects are independent on a fluency-based test. So this outcome indicates that training to conjugate the Class 2 verbs was effective.

For Class 3 verbs rates of corrects were 0 per min before training at Post C2 and increased to 7.5 corrects per min after training at Post C3. This high level persisted at Follow-up. Importantly for this Post C2 to Post 3 comparison there are no control data

for yet another class of verbs. But the rate of 0 corrects per min for Class 3 verbs also occurred at Post C1b and did not increase until after training. This outcome suggests that the training increased rates of corrects. Now consider rates of incorrects. For Class 3 verbs rates of incorrects were 12 per min before training at Post C2 and decreased to 0 per min after training at Post C3. This low level persisted at Follow-up. Also the rate of incorrects before training was 8 per min at Post C1 b and did not decrease until training occurred. These outcomes suggest that training to conjugate Class 3 verbs was effective.

It may be recalled that the Mixed Test contained items from each verb class and required the participant to rapidly switch between conjugations for each class. The accuracy for each of the three class tests as well as the test overall (Mix Overall) are presented in Figure 10.

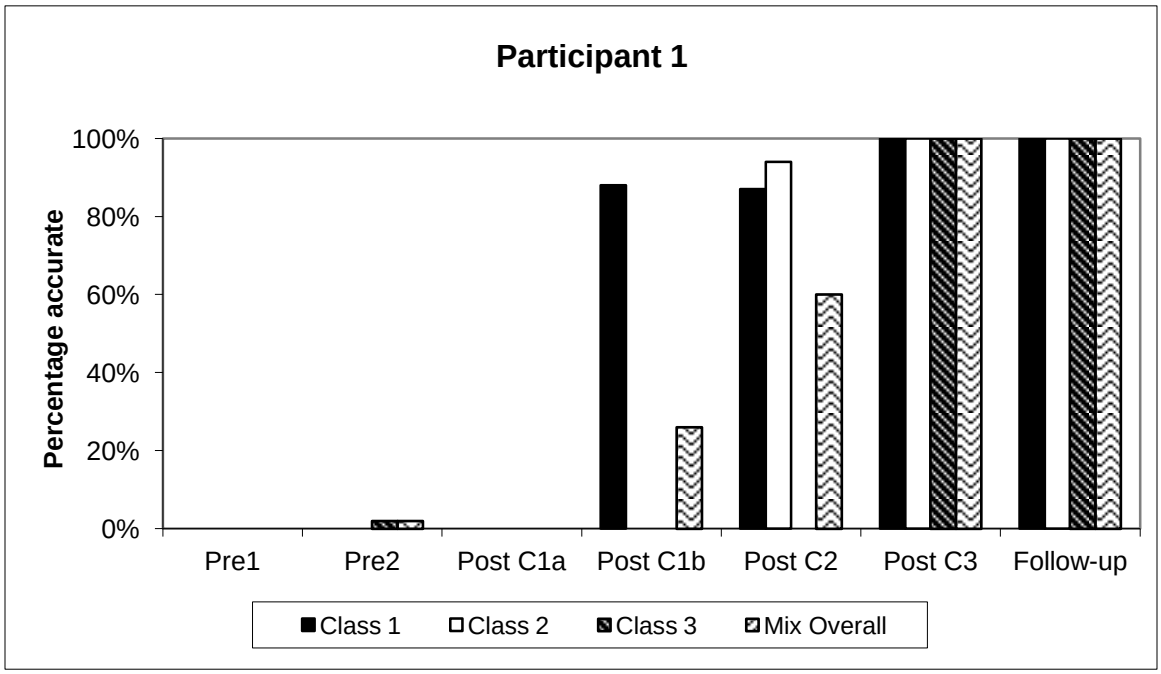


Figure 10. Participant 1's accuracy for each verb-class test and for the Mixed Test overall classes when the battery was administered twice before training, after training on Class 1 verbs, after training on Class 2 verbs, after training on Class 3 verbs, and one month following training.

With the same qualifications, the outcomes for these accuracy data are similar to those for the rate data. With the revised instructions, after training to conjugate Class 1 Participant 1's accuracy was 88% at Post C1b and remained high through Follow-up. Before training to conjugate Class 2 verbs, his accuracy was 0% at Post C1b and after training increased to 94% and remained high through Follow-up. Before training Class 3 verbs, his accuracy was 0% at Post C1b and Post C2 and after training increased to 100% at Post C3 and at Follow-up. Importantly, following the logic of a probe design, his accuracy for conjugating a verb class only increased to 88% or higher after receiving training for the conjugation of a verb class.

Finally, consider Participant 1's overall performance on the Mixed Test. Presumably after training to conjugate Class 1 verbs, his accuracy on the entire test (Mix Overall) should be about 33% as one third of the test's content was indirectly trained. Likewise after training to conjugate Class 2 verbs, his accuracy should be 66%; and after training to conjugate Class 3 verbs, his accuracy should be near 100%. Figure 10 indicates this pattern as the corresponding rates: are 26%, 60%, and 100%. Considering the rate and accuracy data together, the training for Class 2 and Class 3 verbs appears to have been effective although control data for Class 3 verbs were absent.

Participant 2

Training. Participant 2 generally followed the procedure for 44 of the 46 units. However, he rarely achieved perfect accuracy. This outcome indicates a serious procedural problem because advancing to a new unit presumably depended on achieving an aim which required no incorrect responses. Also noteworthy was that Participant 2 was not a native English speaker. Ultimately, though, researcher inattention may explain

Participant 2's failure to follow instructions. Nevertheless, Participant 2's data are worth exploring as he did attain 96% accuracy, on average, across all training units and always achieved the aim for corrects.

Over all units, Participant 2 trained for slightly less than 24 hrs. He trained at least 5 days a week for about 20 min per day. His training sessions were usually 5 min long and he mastered a unit on average after 30 min. Table 11 summarizes Participant 2's performances for each unit. The data for the initial sessions are based on training sessions which as noted were usually 5 min long; the data for the final sessions are based on the probes, the participant had conducted, which were 1 min long. For only two units did Participant 2 achieve accuracy: a final rate of 0 incorrects per min? But for all units Participant 2 achieved or exceeded the aim for corrects.

Table 11

Summary of Participant 2's Performances for each Unit in Terms of: Unit, Aim, Initial Corrects per minute, Final Corrects per minute, Celeration, Initial Incorrects per minute, Final Incorrects per minute, Celeration, and Minutes of Training in Unit

Unit	Aim Corrects: Incorrects /Min	Initial Corrects /Min	Final Corrects /Min	Cel	Initial Incorrects /Min	Final Incorrects /Min	Cel	Training Min
1A	30:0	11	36	3.3	.5	.5	1.0	35
1B	30:0	6.8	33	4.9	6.8	1	0.1	40
1AB	30:0	30.6	30.8	1.0	.4	.6	1.5	20
1C	40:0	45.8	43.2	0.9	0	0	0	20
1D	40:0	39	41.8	1.1	2	1.8	0.9	20
1E	40:0	38.8	42.4	1.1	4.4	2.2	0.5	35
2A	45:0	26.4	45.4	1.7	3.2	2.8	0.9	70
2B	45:0	32.2	45.6	1.4	4	1.8	0.5	40
2AB	45:0	36	46.4	1.3	5.8	2	0.3	70
2C	45:0	37	47.2	1.3	4	.8	0.2	25
2AC	45:0	39.8	45.6	1.1	6.4	1.6	0.3	50
2D	45:0	45.2	49.8	1.1	5.2	2.2	0.4	20
2AD	45:0	40.2	46.2	1.1	7.8	2.2	0.3	35
2E	45:0	59.8	66.4	1.1	0	0	0	20
2AE	45:0	36.4	45.2	1.2	5.8	2	0.3	40
2F	45:0	48.2	48.6	1.0	4.2	2.2	0.5	20
2AF	45:0	38.2	46.2	1.2	4.2	1.2	0.3	35
2G	45:0	46.8	48.2	1.0	3.2	1.8	0.6	20
2AG	45:0	36.4	46.6	1.3	5.8	1.6	0.3	50
2H	45:0	48.2	52.2	1.1	3.2	1.6	0.5	20
2AH	45:0	38.3	47.2	1.2	6.6	1.6	0.2	45
2I (1AB)	30:0	37.2	40.4	1.1	2.4	1.2	0.5	20
2J (1E)	40:0	46.6	49.8	1.1	4.2	1.6	0.4	20
3A	22:0	11.2	29.8	2.7	6.6	1.2	0.2	45
3B	22:0	25.2	28.2	1.1	3.6	1.2	0.3	20
3AB	22:0	18.6	24.6	1.3	4.2	1.6	0.4	88
3C (1E)	40:0	44.2	47.2	1.1	2.8	0.8	0.3	20
3D (1AB)	30:0	30.2	34.8	1.2	4.2	2.2	0.5	20
3E (2A-H)	45:0	33.6	46.8	1.4	4.2	2.2	0.5	45
4A	22:0	14.8	23.8	1.6	6	2.4	0.4	55
4B	22:0	15.8	23.8	1.5	5.8	1.2	0.2	40
4AB	22:0	16.8	24	1.4	5.2	2.2	0.4	30
4C	22:0	14.2	22.8	1.6	6.6	1.6	0.2	30
4D (1E)	40:0	40.2	43.8	1.1	2.2	1.8	0.8	20
4E (1AB)	30:0	29.8	33.2	1.1	3.2	1.2	0.4	25
4F (2A-H)	45:0	38.2	45.2	1.2	3.2	2.2	0.7	35
5A	22:0	15.2	24	1.6	4.6	1.2	0.3	25
5B	22:0	22.4	26.8	1.2	3.2	1.6	0.5	20
5AB	22:0	18.8	23.2	1.2	3.8	2.2	0.6	25
5C	22:0	13.6	24.4	1.8	5.8	1.6	0.3	35
5D (1E)	40:0	45.2	47.6	1.1	2.2	1.6	0.7	20
5E (1AB)	30:0	30.8	34.2	1.1	2.2	1.2	0.5	20
5F (2A-H)	45:0	29.8	46.2	1.6	4.8	2.8	0.6	45

Table 11 indicates that Participant 2 did not always become more proficient when completing conceptually equivalent units. The times to complete Unit 3A, 4A, and 5A were 45, 55, and 25 min, respectively. Those for Unit 3B, 4B, and 5B were 20, 40, and 20 min, respectively. Those for Unit 3AB, 4AB, and 5AB were 85, 30, and 25 min, respectively. Only for the latter units did the times for achieving an aim uniformly decrease across modules.

Table 11 summarizes Participant 2's performances. Also interesting is a more fine-grained analysis. Such an analysis is presented in Figure 11, below, for Module 3 because performances in this module were typical of performances in the other modules. The record floor varies because training sessions were not always 5 min long. Rates of corrects per minute are indicated with ●'s and rates of incorrects per minute are indicated with X's.

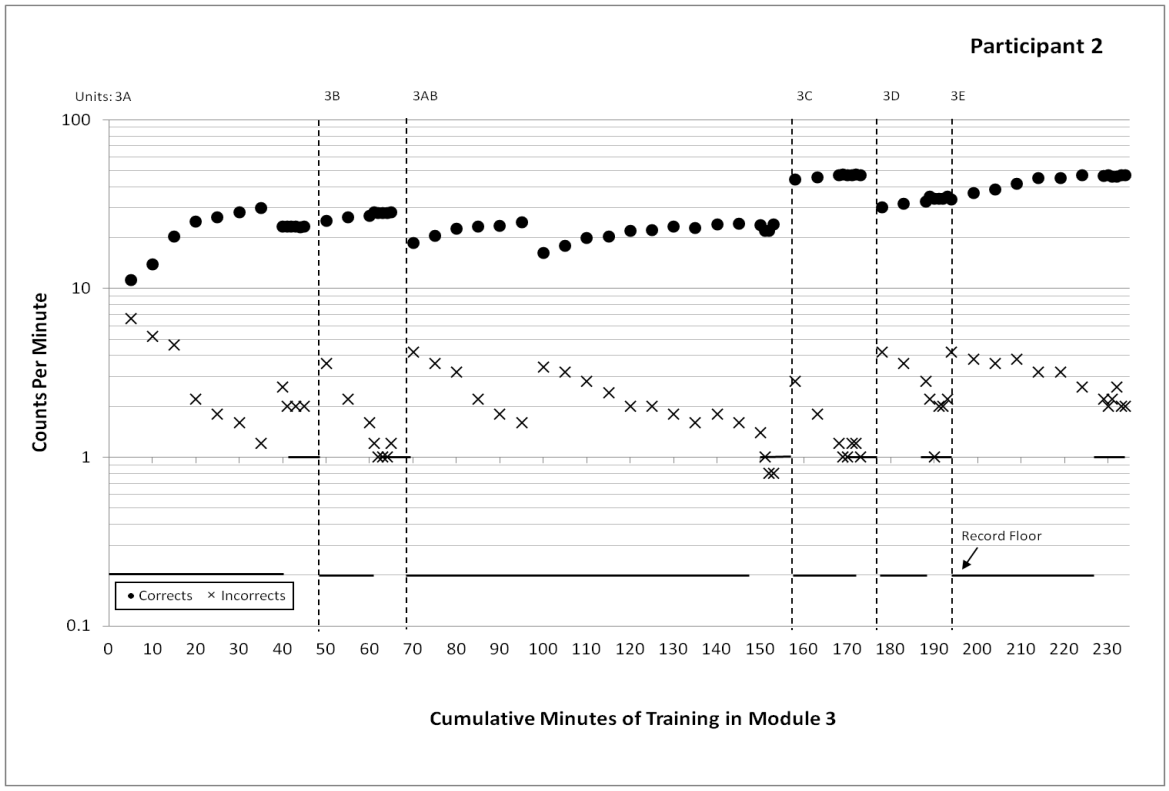


Figure 11. Participant 2's rates of corrects and incorrects for the units in Module 3.

Worth noting in Figure 11 is the "open –jaws" pattern as shown by rates of corrects multiplying and rates of incorrects dividing with training. The rates of incorrects in Module 3 for the final units ranged from .2 to .4 and averaged .4 /min. Although these rates are not zero, these rates along with the open-jaws pattern may have contributed to the researcher's assuming accuracy had been achieved. Also noteworthy is the discontinuity of the learning picture between the 90th and 100th minute. This may be due to Participant 2 not training for three days.

Transfer. For Participant 2 the revised test instructions were used throughout the experiment and the test batteries were presented as planned: twice before training, following training to conjugate each verb class, and at Follow-up. The results for these tests appear in Figure 12.

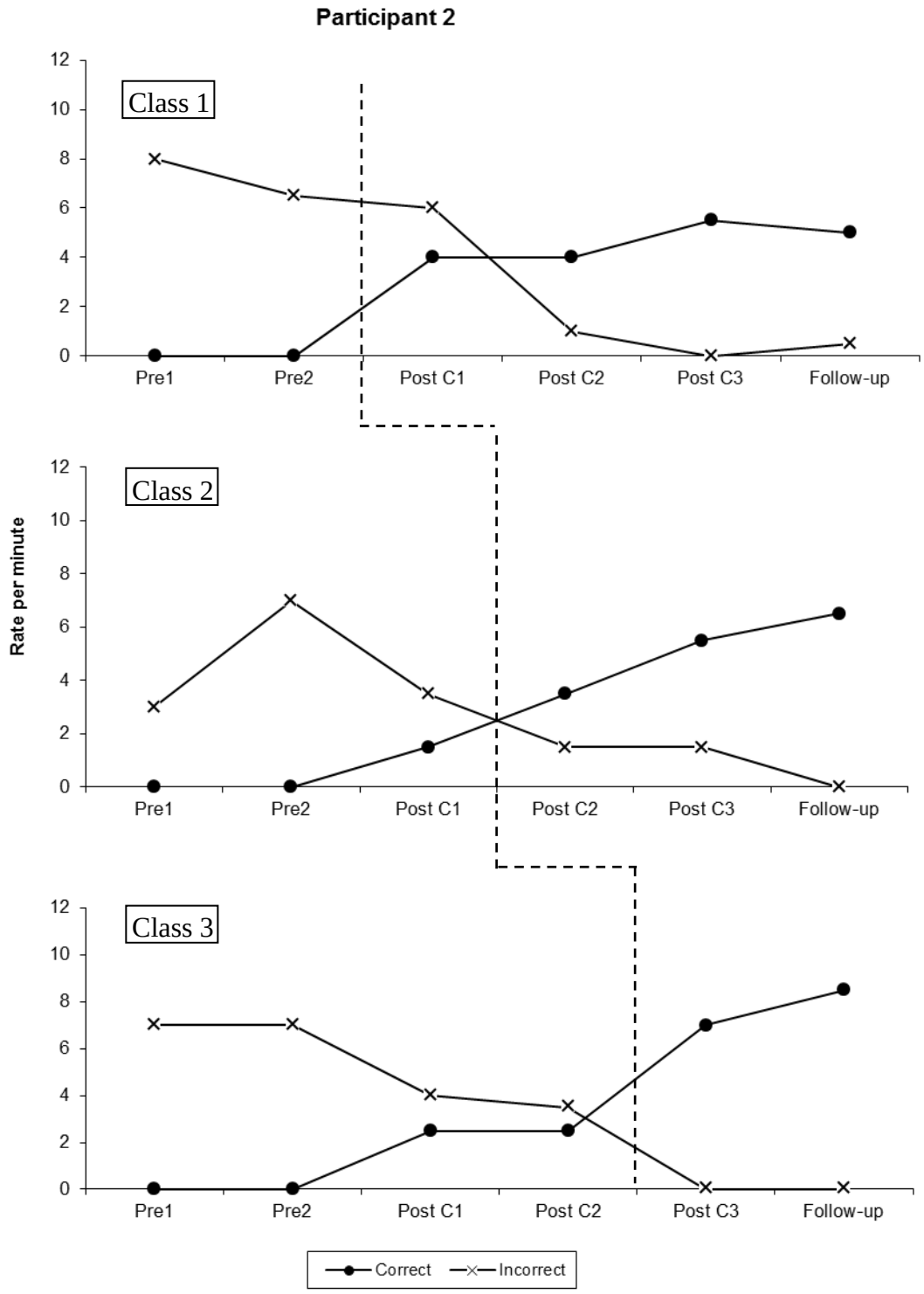


Figure 12. Participant 2's correct ('●') and incorrect ('X') conjugations per minute for each class test when the battery was administered twice before training, after training on Class 1 verbs, after training on Class 2 verbs, after training on Class 3 verbs, and one month following training.

The top panel of Figure 12 indicates that before training to conjugate Class 1 verbs, rates of corrects for Class 1 verbs were 0 per min at Pre1 and Pre2, and increased after training to 4 min at Post C1. This rate increased somewhat by Follow-up. Although this outcome suggests that training was effective, the "control" baselines for the Class 2 and Class 3 verbs must considered. For both classes the Pre2 to Post C1 comparison reveals increments for corrects of 1.5 and 2.5 per min, respectively. Because the latter increment is about the same as found for the Pre2 to Post C1 comparison for Class 1 verbs, it is not clear that training was effective.

Now consider the incorrects for Class 1 verbs. From Pre 1 to Pre 2 rates of incorrects were trending downward from 8 to 6.5 per min and decreased only by 0.5 min to 6 per min at Post C1, after training to conjugate Class 1 verbs. Now consider the baseline data for the Class 2 and Class 3 verbs. For both classes, the Pre 2 to Post C1 comparison reveals decrements of 3 per min from 7 per min to 3.5-4 per min. Given the results for corrects and incorrects, training to conjugate Class 1 verbs was judged to be ineffective.

The middle panel of Figure 12 presents the data for Class 2 verbs. Before training to conjugate Class 2 verbs, the rates of corrects trended upward from 0 per min at Pre2 to 2 per min at Post C1. After training the rate of corrects increased to 3.5 per min at Post C2 but this increment appears to continue the trend that began at Post C1 and continued to Follow-up. The baseline data for the Class 3 verbs reveals no change from Post C1 to Post C2 remaining 2.5 min. These data indicate that training to conjugate C2 verbs was ineffective.

For Class 2 verbs, the data for incorrects indicate much the same pattern. Incorrects trended downward before training and decreased at about the same rate up to follow-up. Much the pattern occurred for the control data for Class 3 verbs. The data for rates of corrects and incorrects indicate that training to conjugate Class 2 verbs was ineffective.

For Class 3 verbs rates of corrects were 2.5 min before training at Post C2 and increased to 7 per min after training at Post C3. This high level persisted and increased at Follow-up. For the Post C2 to Post C3 comparison there are, however, no control data for another class of verbs. But the rate of 2.5 per min for Class 3 verbs also occurred at Post C1 and did not increase until after training. This outcome suggests that the training increased rates of corrects.

Now consider rates of incorrects. For Class 3 verbs rates of incorrects were 3.5 min before training at Post C2 and decreased to 0 per min after training at Post C3. This low level persisted at Follow-up. The data for corrects and incorrects suggest that training to conjugate Class 3 verbs may have been effective.

The Mixed Test contained items from each verb class and required the participant to rapidly switch between conjugations for each class. The accuracy for each of the three class tests as well as the test overall (Mix Overall) are presented in Figure 13.

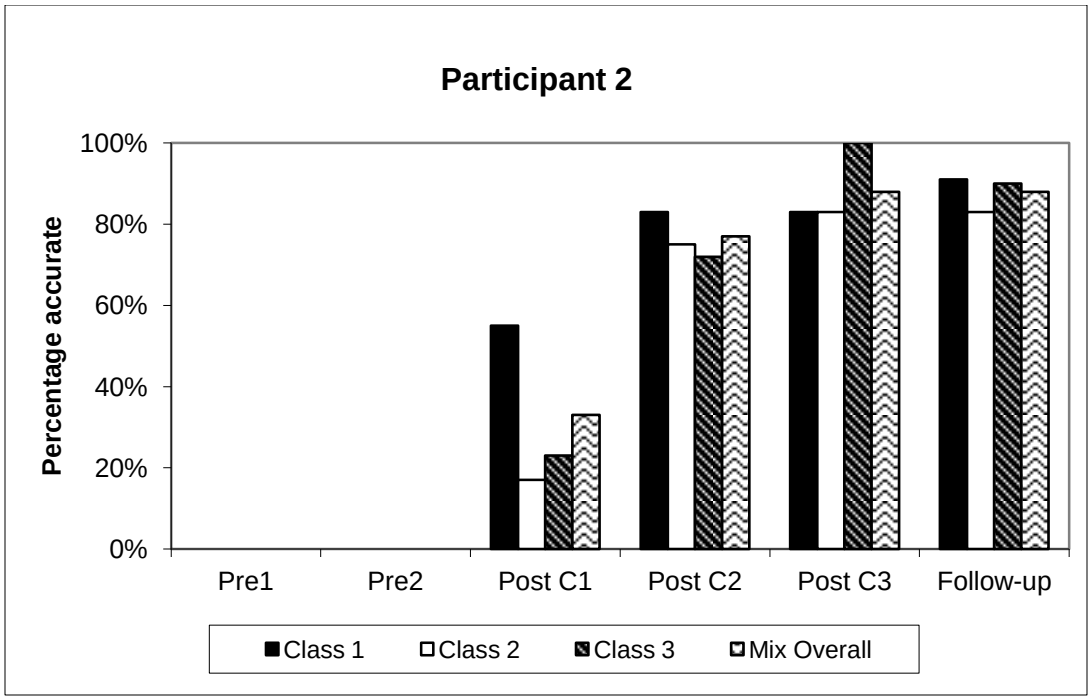


Figure 13. Participant 2's accuracy for each verb-class test and for the Mixed Test overall classes when the battery was administered twice before training, after training on Class 1 verbs, after training on Class 2 verbs, after training on Class 3 verbs, and one month following training.

Before any training Participant 2 could not conjugate any of the verbs as his accuracy was 0% at Pre1 and Pre2 for all verb classes. But after training to conjugate Class1 verbs, the subsequent tests, at Post C1, reveal that his accuracy for all verb classes improved. Improvement for Class 1 verbs was the greatest, a difference of 55%, whereas the next closest numeric difference was to 34% for Class 3 verbs. For Class 1 verbs accuracy was high through Follow-up. This result suggests that training to conjugate Class 1 verbs was effective. After training to conjugate Class 2 verbs, his accuracy for these verbs increased from 17% at Post C1 to 75% at Post C2, a numeric difference of 58%. However, the same comparison for Class 3 verbs reveals accuracy increased equivalently from 22% to 72%, a numeric difference of 53%. This result suggests that the class tests were not independent. Finally, after training to conjugate Class 3 verbs, his

accuracy increased from 72% at Post C2 to 100% at Post C3, a numeric difference of 11%. Overall these data suggest that either training was ineffective or the independence assumption for the probe design was false.

Participant 2's performance on the Mixed Test suggest that the independence assumption may have been violated. Presumably after training to conjugate Class 1 verbs his accuracy on the entire test (Mix Overall) should be about 30% as one third of the test's content was indirectly trained. Likewise after training to conjugation Class 2 verbs his accuracy should be 60%, and after training to conjugate Class 3 verbs his accuracy should be near 100%. However Figure 13 indicates a different pattern. After training to conjugate Class 1 verbs his accuracy is 33%, but after training Class 2 verbs his accuracy is 77%, and after training Class 3 verbs his accuracy is 88%. Considering the rate and accuracy data together, training did not appear to have been effective.

Participant 3

Training. Participant 3 followed the procedure with some departures. These included advancing to units before mastery and training with units out of sequence. The training of units out of sequence occurred only in Module 1. This did not occur again after the relevant instructions were repeated to Participant 3. Also although Participant 3 reportedly trained for the required minimum of 20 min daily the computer logs revealed that training times were occasionally 5-10 min less than reported.

Upon review of his computer logs, over all units, Participant 3 trained for slightly more than 11 hours. He trained at least 5 days a week for about 9 min per day. His

training sessions typically ranged from 1 to 5 min and mastery required an average of 8.6 min per unit.

Table 12 summarizes Participant 3's performance for each unit. His data for the initial sessions are based on training sessions that, as noted, were usually 5 min long. His data for the final sessions are based on the final 1-min probes.

Table 12 indicates that for each unit Participant 3 achieved accuracy as his final rate of incorrects was 0 per min. Also, for each unit, Participant 3 achieved fluency as his final rate of corrects exceeded each unit's aim.

Table 12

Summary of Participant 3's Performances for each Unit in Terms of: Unit, Aim, Initial Corrects per minute, Final Corrects per minute, Celeration, Initial Incorrects per minute, Final Incorrects per minute, Celeration, and Minutes of Training in Unit

Unit	Aim Corrects: Incorrects /Min	Initial Corrects /Min	Final Corrects /Min	Cel	Initial Incorrects /Min	Final Incorrects /Min	Cel	Training Min
1A	30:0	2.6	45	17.3	1.6	0	0	27
1B	30:0	0	43	1	4	0	0	16
1AB	30:0	4.6	43	9.4	1	0	0	47
1C	40:0	9.8	42	4.3	.1	0	0	26
1D	40:0	6	51	8.5	3.3	0	0	42
1E	40:0	13	71	5.5	.3	0	0	17
2A	45:0	3.1	46	14.8	8	0	0	33
2B	45:0	14.8	49	3.3	0.2	0	0	18
2AB	45:0	19	49	2.8	4	0	0	12
2C	45:0	28.2	49	1.7	0.6	0	0	13
2AC	45:0	38	49	0.7	0	0	0	9
2D	45:0	31.8	48	1.5	0.4	0	0	10
2AD	45:0	42	51	1.2	0	0	0	12
2E	45:0	51.4	71	0.7	0	0	0	8
2AE	45:0	48	52	1.1	0	0	0	3
2F	45:0	30.8	46	1.5	0.6	0	0	8
2AF	45:0	43	54	1.1	0	0	0	4
2G	45:0	38	52	1.4	1	0	0	4
2AG	45:0	47	49	1.0	0	0	0	3
2H	45:0	36.6	65	1.8	0.8	0	0	8
2AH	45:0	53	54	1.0	0	0	0	4
2I (1AB)	30:0	30	46	1.5	3	0	0	3
2J (1E)	40:0	51	63	1.2	0	0	0	3
3A	22:0	5	29	5.80	4.4	0	0	24
3B	22:0	15	28	1.87	1	0	0	8
3AB	22:0	5	26.6	5.32	4	0	0	9
3C (1E)	40:0	62.4	47.5	0.76	0.2	0	0	8
3D (1AB)	30:0	40	40.6	1.02	1	0	0	3
3E (2A-H)	45:0	48	48	1.00	0	0	0	3
4A	22:0	11.6	31	2.67	1	0	0	8
4B	22:0	24	24.2	1.01	0	0	0	3
4AB	22:0	26	28	1.08	0	0	0	11
4C	22:0	17	25.4	1.49	0	0	0	17
4D (1E)	40:0	36	54.8	1.52	0	0	0	8
4E (1AB)	30:0	26.4	37.4	1.42	0	0	0	8
4F (2A-H)	45:0	37.8	35	0.93	0	0	0	8
5A	22:0	14.6	28	1.92	0.8	0	0	10
5B	22:0	23.8	34	1.43	0.2	0	0	10
5AB	22:0	28	32	1.14	0	0	0	5
5C	22:0	25.6	31.2	1.22	0.4	0	0	31
5D (1E)	40:0	41	56.4	1.38	0	0	0	16
5E (1AB)	30:0	39	45	1.15	0	0	0	17
5F (2A-H)	45:0	52	50	0.96	0	0	0	16

Table 12 indicates that Participant 3 did not become increasingly proficient when completing conceptually equivalent units as training progressed. The A units are conceptually equivalent across Modules 3-5. The times for Unit 3A, 4A, and 5A were 24, 8, and 10 min, respectively. The B units were also conceptually similar as were the AB units. The times for Unit 3B, 4B, and 5B were 8, 3, and 10 min, respectively. The times for Unit 3AB, 4AB, and 5AB were 9, 11, and 5 min, respectively.

Table 12 summarizes Participant 3's performances. Also interesting is a more fine-grained analysis. Such an analysis is presented in Figure 14, below, for Module 3 because performances in this module were typical of performances in the other modules. The record floor varies because training sessions were not always 5 min long. Rates of corrects per minute are indicated with ●'s and rates of incorrects per minute are indicated with X's. Worth noting in Figure 14 is the "open –jaws" pattern as shown by his rates of corrects multiplying and his rates of incorrects dividing with training. His rates of incorrects in Module 3 for the final units were zero for all units.

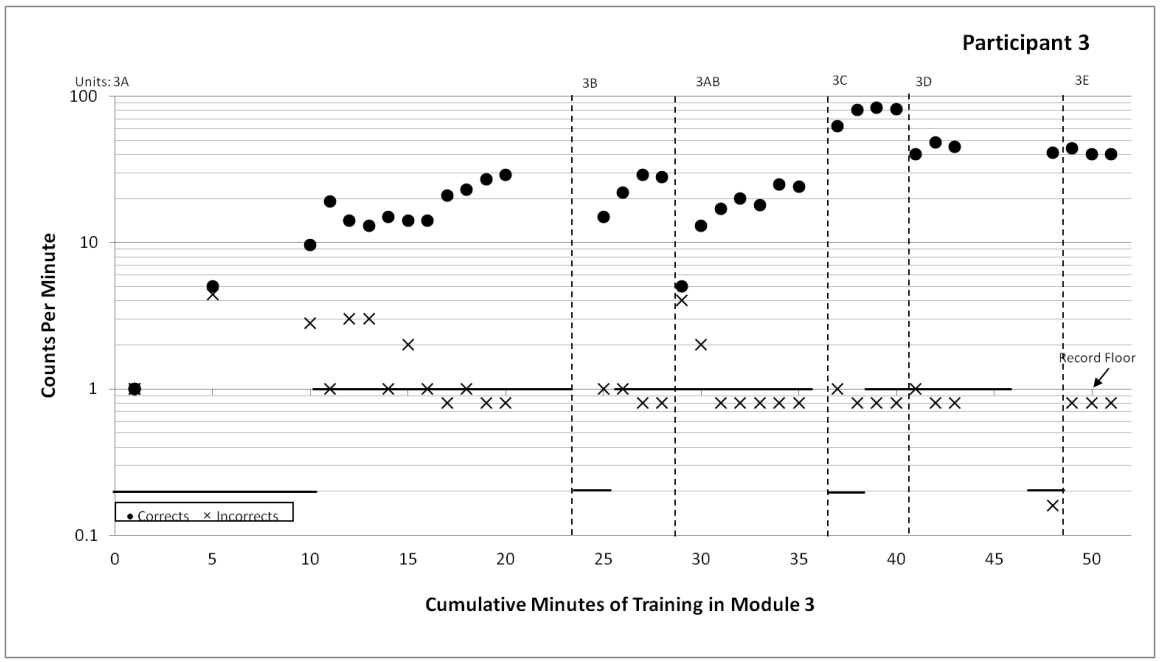


Figure 14. Participant 3's rates of corrects and incorrects for the units in Module 3.

Transfer. For Participant 3 the revised test instructions were used throughout the experiment and the test batteries were presented as planned: twice before training, following training to conjugate each verb class, and at Follow-up. The results for these tests appear in Figure 15.

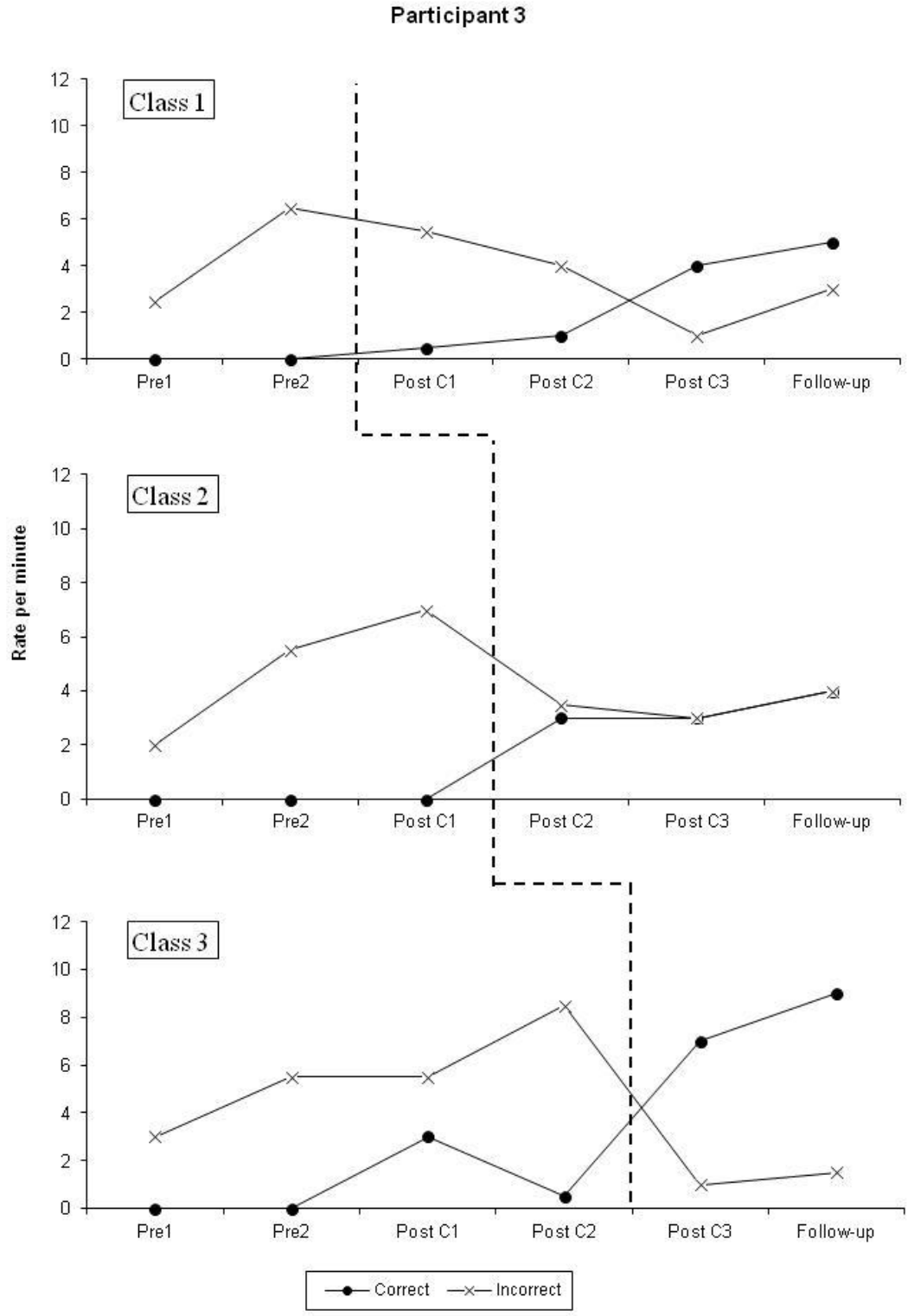


Figure 15. Participant 3's correct ('●') and incorrect ('X') conjugations /min for each class test when the battery was administered twice before training, after training on Class 1 verbs, after training on Class 2 verbs, after training on Class 3 verbs, and one month following training.

The top panel of Figure 15 indicates that before training to conjugate Class 1 verbs, his rates of corrects for Class 1 verbs were 0 per min at Pre1 and Pre2, and increased after training to 0.5 per min at Post C1. This rate gradually increased somewhat by Follow-up to 5 corrects per min. The "control" baselines for the Class 2 and Class 3 verbs must also be considered. For the Pre2 to Post C1 comparison no increase occurred for Class 2 verbs and an increase of 3 per min occurred for Class 3 verbs. Because the latter increment for a class of verbs whose conjugation had not been trained was greater than the increment for a class of verbs whose conjugation had been trained, training does not appear to have enhanced rates of corrects.

Now consider the incorrects for Class 1 verbs. From Pre 1 to Pre 2 his rates of incorrects increased from 2.5 to 6.5 per min and decreased only by 1 per min to 5.5 per min at Post C1, after training to conjugate Class 1 verbs. Now consider the baseline data for the Class 2 and Class 3 verbs. For both classes, the Pre 2 to Post C1 comparison reveals increments of 1.5 min and 0 per min for incorrects. The reduction in rates of incorrects only for the class of verbs whose conjugation relative to the increments for the other classes is interesting but the reduction is quite small. Considering these outcomes and those for the incorrects, it does not appear that training was effective for Class 1 verbs.

The middle panel of Figure 15 presents the data for Class 2 verbs. Before training to conjugate these Class 2 verbs, his rates of corrects were 0 per min at Post C1 and increased to 3 per min at Post C2 and remained high to Follow-up. The same Post C1 to Post C2 comparison for his baseline data for the Class 3 verbs reveals a decrement of

about 2.5 corrects per minute. These data suggest that training to conjugate C2 verbs was effective with respect to rates of corrects.

Now consider his incorrects for Class 2 verbs. The Post C1 to Post C2 comparison reveals a decrease of about 2.5 per min. However, for Class 3 verbs this comparison reveals an increase for incorrects of 2.5 per min. The reduction in incorrects for Class 2 Verbs and increment in incorrects for Class 3 verbs suggests that the training to conjugate Class 2 verbs reduced incorrects for these verbs but the rate was not reduced to zero. From Post C2 through Follow-up the participant's corrects and incorrects were at about 4/min. Together the results for the Class 2 verbs suggest that training affected conjugation but the terminal rates suggest an accuracy of just 50%.

For Class 3 verbs his rates of corrects were 0.5 per min before training at Post C2 and increased to 7 corrects per min after training at Post C3 and to 9 per min at Follow-up Importantly for the Post C2 to Post 3 comparison there were no control data for another class of verbs. Nevertheless, this outcome suggests that training may have increased rates of corrects.

Now consider rates of incorrects. For Class 3 verbs his rates of incorrects were 8.5 per min before training at Post C2 and decreased to 1 per min after training at Post C3. This low level also occurred at Follow-up. This outcome suggests that training to conjugate Class 3 verbs may have reduced rates of incorrects. Taken together, these findings for Class 3 verbs are consistent with training being effective but again there were no control data.

The Mixed Test contained items from each verb class and required the participant to rapidly switch between conjugations for each class. The accuracy for each of the three class tests as well as the test overall (Mix Overall) are presented in Figure 16.

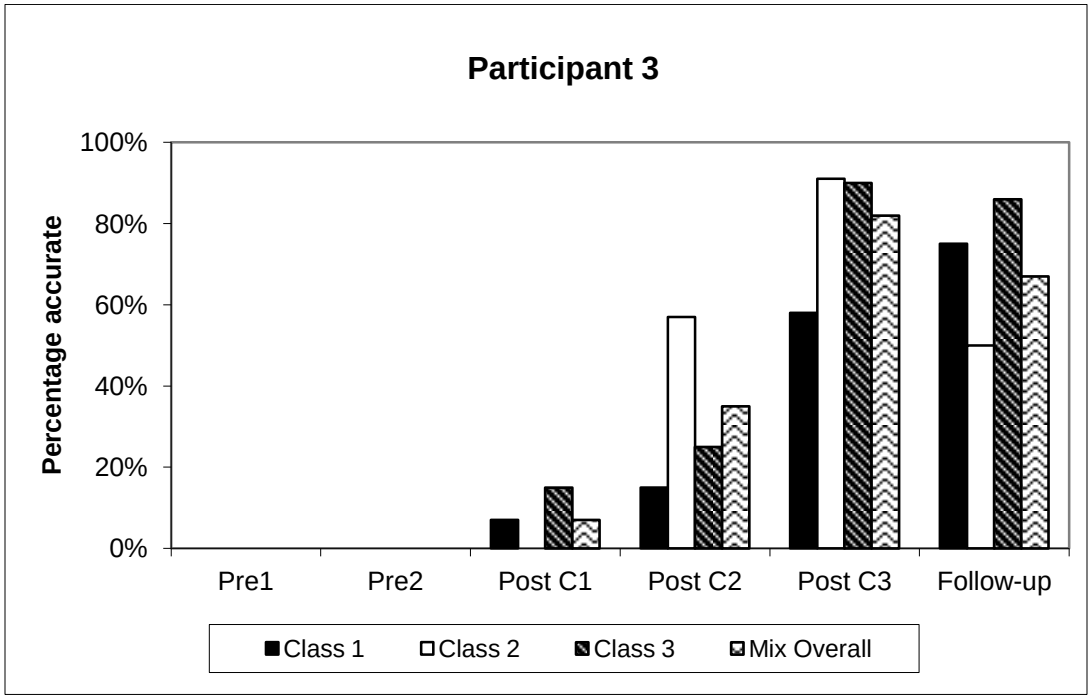


Figure 16. Participant 3's accuracy for each verb-class test and for the Mixed Test overall classes when the battery was administered twice before training, after training on Class 1 verbs, after training on Class 2 verbs, after training on Class 3 verbs, and one month following training.

Before any training Participant 3 did not conjugate any of the verbs; his accuracy was 0% at Pre1 and Pre2 for all verb classes. But after training to conjugate Class 1 verbs the Post C1 tests revealed that his accuracy for Class 1 verbs increased to 7% while accuracy for Class 2 verbs remained at 0%, and accuracy for Class 3 verbs increased to 15%. The greater gain for Class 3 verbs than Class 1 verbs suggests that these verb classes were not independent and preclude evaluating whether training for Class 1 verbs enhanced accuracy. Worth noting, however, is that accuracy for Class 1 verbs increased as training continued.

After training to conjugate Class 2 verbs, his accuracy for these verbs increased from 0% at Post C1 to 57% at Post C2, a gain of 57%. However, the same comparison for Class 3 verbs reveals accuracy increased as well from 15% to 25%, a gain of 10%. The greater gain for Class 2 verbs than Class 3 verbs suggests that training to conjugate Class 2 verbs may have been effective. It should be noted that his accuracy for Class 2 verbs increased at Post C3 to 91% but decreased at Follow-up to 50%.

Finally, after training to conjugate Class 3 verbs, his accuracy increased from 25% at Post C2 to 90% at Post C3, the largest increase. This large gain for Class 3 verbs only occurs after training Class 3 verbs and suggests that the training may have increased accuracy on the Mixed Test. These inconsistent outcomes suggest that either the training was ineffective or the independence assumption for the probe design was violated.

The results for the Mixed Test suggest that independence assumption may have been violated. After training to conjugate Class 1 verbs, Participant 3's accuracy on the entire test (Mix Overall) should be about 33%, as one third of the test's content was indirectly trained. Likewise after training to conjugation Class 2 verbs accuracy should be about 66%, and after training to conjugate Class 3 verbs accuracy should be near 100%. But Figure 13 indicates a different pattern for responding on the Mixed Test. After training to conjugate Class 1 verbs accuracy is 7%, but after training Class 2 verbs accuracy is 35%, and after training Class 3 verbs accuracy is 82%. Considering the rate and accuracy data together, training appears to have been ineffective.

Discussion

This study explored whether a treatment package that included a series of training units could teach English speaking students who could not conjugate particular Spanish verbs to conjugate them in the context of clauses. The units were designed to teach (a) prerequisite skills, (b) three verb classes, and (c) the conjugation of two verbs in each class. With these units, participants trained for an average of 16 min daily. Also participants met with the researcher twice weekly to evaluate progress and verify records of training.

To assess the effectiveness of training a battery of four tests was constructed. Each of three of the tests required conjugating verbs that were from one of the three verb classes but whose conjugation had not been directly trained. A fourth test, a mixed test, combined items from the aforementioned tests to assess whether the participant could shift from one class to another while conjugating verbs. All four tests were timed so that rates of correct and incorrect responding could be assessed. Finally, the training units and the test battery were arranged to form a multiple probe design.

Across participants results varied. To simplify interpretation, below only large changes will be discussed that are likely to be *socially important*. For the rate measures, only changes of six or more responses per minute will be tentatively considered socially important. For the accuracy data for the Mixed Test, only changes of 45% or more will be tentatively considered socially important. Surely, not every difference is socially important but these differences would most likely approximate socially valid changes (Bailey & Burch, 2002, pp. 81-87).

Discussion of Each Participant's Performance

Participant 1. If the difficulty with test instructions can be ignored but social importance is considered, then the rate data from the transfer tests revealed this participant learned to conjugate verbs (Class 2 and Class 3). Both the rate data from the class tests (Figure 9) and the accuracy data from the Mixed Test (Figure 10) reveal that conjugating immediately improved only for a class whose conjugations had been trained.

Participant 2. If the absence of perfect accuracy can be ignored, but social importance is considered, then neither the rate data nor the accuracy data suggest that training enhanced conjugating Class 1 and Class 2 verbs. Improvements following training may be attributed to the pre-training data improving before training occurred (trending) or the post-training data improving for a verb class whose conjugation had not been trained (transfer). The rate data do suggest that training for conjugating Class 3 verbs may have enhanced conjugating these verbs (Figure 12, bottom panel). Unfortunately, there was not a fourth class of verbs to serve as a control for the improvements in rates of conjugating Class 3 verbs. The accuracy data from the Mixed Test did not permit evaluating the effectiveness of each training unit because of trending and transfer. Worth noting is that across the course of the study there were large, tentatively socially important improvements in rates and accuracy for all verb classes (Figures 12-13).

Participant 3. If the departures from training can be ignored but social importance considered, the rate data for the transfer tests suggest that only training for conjugating Class 3 verbs may have enhanced conjugating Class 3 verbs (Figure 15, bottom panel). Again, there was not a fourth class of verbs to serve as a control for the

improvements in rates for conjugating Class 3 verbs. As for the accuracy data from the Mixed Test, trending and transfer precluded assessing whether training was effective. Worth noting again is that during the course of the study there were large, tentatively socially important improvements in accuracy for all verb classes (Figure 16).

General Discussion

Social Importance. Training did improve Participant 1's fluency at conjugating verbs. But how did his final rates compare with those of a native speaker? To answer this question a bilingual, native speaker of Spanish, born in El Salvador, completed the battery. For this speaker on the aforementioned battery and for the participants on the Follow-up battery, Table 13 shows rates of corrects and incorrects per minute, separated by a colon, and accuracy. For these measures only Participant 1's profile well approximates the bilingual speaker's profile.

Table 13

For the Bilingual Speaker and for All Participants after at Follow-Up: Rates of Corrects and Incorrects per Minute and Accuracy on Test Battery

Person	Class 1	Class 2	Class 3	Mixed
Participant 1	*6:0* *100%*	*8.5:0* *100%*	6.5:0 100%	6.5:0 100%
Participant 2	*5:.05* *91%*	6.5:0 100%	8.5:0 100%	5.5:0.7 88%
Participant 3	*5:3* *63%*	4:4 50%	9:1.5 86%	5.3:2.5 67%
Bilingual Speaker	*6.5:0.5* *92%*	6.5:1 87%	8.5:0 100%	7.1:0.4 95%

Improving Future Research. The positive results for only one of three participants indicates the need for improvement in instructional and research methods. One clue about what might have gone wrong is suggested by the amounts of time required to reach aims for conceptually identical units and operationally identical units. As noted above, as training progressed only one participant became increasingly efficient (required less time) to complete conceptually equivalent units. This was also true for operationally identically units as shown in Tables 14-16. In contrast, increased efficiency was not generally evident for the remaining participants. Worth noting is that the times to complete a unit were based on software records for Participants 1 and 3 and self-report for Participant 2.

Table 14

For All Participants Minutes to Attain Aim for Unit 1AB

Encounter	Participant 1	Participant 2	Participant 3
First	21	20	47
Second	4	20	3
Third	7	20	3
Fourth	3	25	8
Fifth	3	20	17

Table 15

For All Participants Minutes to Attain Aim for Unit 1E

Encounter	Participant 1	Participant 2	Participant 3
First	8	20	17
Second	6	20	3
Third	8	20	8
Fourth	3	20	8
Fifth	4	20	16

Table 16

For All Participants Minutes to Attain Aim for Unit 2A-H

Encounter	Participant 1	Participant 2	Participant 3
First	6	45	4
Second	9	45	3
Third	3	35	8
Fourth	3	45	16

These results suggest that Participants 2 and 3 could have profited from additional practice within each unit. This suggests that aims requiring greater fluency would have been helpful. But the utility of merely using aims to define mastery has been questioned by Fabrizio and Stahr (2005). They recommend examining the initial rates for novel but conceptually identical units. For these units, *initial* rates should improve as these units are encountered. Rising initial rates for such novel units presumably better marks learning than does attaining an aim for determining when training with a unit should be terminated.

Besides requiring more practice for participants who did not become increasingly proficient, the multiple probe design itself was troublesome. Although three classes of verbs were identified whose conjugations in the preterit were almost entirely different, transfer appeared to occur across these classes as trending. For obvious reasons, this problem would have not likely occurred if participants were without any "knowledge" of Spanish or a related Romance language.

Worth noting is that the one participant for whom the treatment package worked was a relative of the principal investigator. He also was a student finishing a doctoral degree but was not financially compensated for participation. In contrast, the other participants were unrelated to the principal investigator, were not earning advanced degrees, and were financially compensated for participation. Although there are multiple differences here, the skills correlated with earning an advanced degree may have contributed to the success of the treatment package for this participant.

It is unclear whether the multiple probe design or failure to follow directions, or other factors caused poor outcomes for two of the participants. What is clear is that although most software for teaching foreign languages has not been evaluated for effectiveness (Nelson, 2011), the software used in this study was evaluated as part of a treatment package. That evaluation indicates that the package has some promise as indicated by the performances of Participant 1 and the favorable comparison of this participant's performances with those of the bilingual speaker.

References

Bailey, J.S.& Burch, M.R. (2002). *Research methods in applied behavior analysis.* Thousand Oaks, CA: Sage Publications.

Binder, C. (1996). Behavioral fluency: Evolution of a new paradigm. *The Behavior Analyst, 19,* 163-197.

Calkin, A. B. (1996). Learning Russian. *Journal of Precision Teaching and Celeration, 14,* 57-71.

Cihon, T. M. (2007). A review of training intraverbal repertoires: Can precision teaching help? *The Analysis of Verbal Behavior*, *23,* 123-133.

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). *Applied behavior analysis* (2nd ed.). Upper Saddle River, NJ : Pearson/Merrill-Prentice Hall.

FLES Adaptations: Adaptation 5. (2002). Pegasus World Wide Web Server. Available: http://pegasus.cc.ucf.edu/~fle/fulladapt.html.

Eshleman, J. W. (2000a). *Guidelines and considerations for SAFMEDS.* Retrieved July 8, 2008, from http://members.aol.com/standardcharter/safmeds.html.

Eshleman, J. W. (2000b). *Teaching to fluency vs. drill & practice.* Retrieved June 22, 2008, from http://members.aol.com/JohnEshleman/comment06.html.

Eshleman, J. W. (2002). *Learning pictures menu.* Retrieved June, 22, 2008, from http://standardcelerationcharttopics.pbworks.com/w/page/15573469/Learning%20Pictures.

Fabrizio, M. A.& Stahr, R. (2005). The role of initial frequencies in evaluating student performance in curricular sequences with infinite ranges. *Journal of Precision Teaching and Celeration, 21,* 19-21.

Gatbonton, E., & Segalowitz, N. (2005). Rethinking communicative language teaching: A focus on access to fluency. *The Canadian Modern Language Review, 61,* 325-353.

Gascoigne, C. (2002). *The debate on grammar in second language acquisition-past, present, and future.* Lewiston, NY: The Edwin Mellen Press.

Green, G., & Saunders, R. R. (1998). Stimulus equivalence. In K. A. Lattal & M. Perone (Eds.), *Handbook of research methods in human operant behavior* (pp. 229–262). New York: Plenum.

Harrington, M. I., Hunt, J. E., & Israel, M. L. (2007). *The use of a precision teaching computer curriculum to teach Greek prefixes and suffixes.* Canton, MA: Judge Rotenberg Educational Center. Retrieved July 7, 2008 from http://www.effectivetreatment.org/greekprefixes.html

Johnson, K. R., & Layng, T. V. J. (1994). The Morningside model of generative instruction. In R. Gardner III., D. M. Sainato, J. O. Cooper, T. E. Heron & W. L. Heward (Eds.), *Behavior analysis in education: Focus on measurably superior instruction* (pp. 173-197). Belmont CA: Brooks-Cole.

Johnson, K. R., & Layng, T. V. J. (1996). On terms and procedures: Fluency. *The Behavior Analyst, 19,* 281-288.

Johnson, K. J., & Street, E. M. (2004). *The Morningside model of generative instruction: What it means to leave no child behind.* Concord, MA: Cambridge Center for Behavioral Studies.

Kirsch, C. (2006). *Fluency training the declension of German articles.* Unpublished master's thesis, University of Wisconsin-Milwaukee.

Kirsch, C., Schwartz, R. , & Dermer, M. L. (2008). *Declining German articles through fluency training: A manual for StarFAST software.* Unpublished manuscript. University of Wisconsin-Milwaukee.

Kubina, R. M., & Wolfe, P. (2005). Potential applications of behavioral fluency for students with autism. *Exceptionality, 13,* 35-44.

Leonard, I. A. (1925). The organization of the Spanish verb. *Hispania, 8,* 29-36

Madrid, D., & Torres, I. (1986). An experimental approach to language training in second language acquisition: Focus on negation. *Journal of Applied Behavior Analysis, 19,* 203-208.

Mayfield, K. H., & Chase, P. N. (2002). The effects of cumulative practice on mathematics problem solving. *Journal of Applied Behavior Analysis, 35,* 105–123.

Nelson, K.B. (2011) Self-study with language learning software in the workplace: what happens? *Language Learning & Technology. 15,* 110-129.

Pimsleur, P. (1960). Pattern drills in French. *The French Review,* 33, 568-576.

Polson, D. A. D., Grabavac, D. M., & Parsons, J. A. (1997). Intraverbal stimulus-response reversibility: Fluency, familiarity effects, and implications for stimulus equivalence. *The Analysis of Verbal Behavior, 14,* 19-40.

Polson, D. A. D., & Parsons, J. A. (2000). Selection-based versus topography-based responding: An important distinction for stimulus equivalence? *Analysis of Verbal Behavior, 17,* 105-128.

Savignon, S. J. (1991). Research on the role of communication in classroom-based foreign language acquisition: On the interpretation, expression, and negotiation of

meaning. In B. F. Freed (Ed.), *Foreign language acquisition research and the classroom* (pp. 31-45). Lexington, MA: D. C. Heath.

Sharp, D. (2001). *Those who don't speak Spanish may be left behind.* Retrieved February 05, 2008 from USA Today, http://www.usatoday.com/news/nation/2001-05-09-spanish-usat.htm

Skinner, B. F. (1957). *Verbal behavior.* New York: Appleton-Century-Crofts.

Stein, K. W. (2003, April 21). Europeans are from Venus-Americans are from Mars. *Orlando Sentinel,* p. 17.

Sulzer-Azaroff, B., & Mayer, G. R. (1991). *Behavior analysis for lasting change.* Fort Worth, TX: Harcourt Brace.

Sundberg, M. L. (1991). 301 research topics from Skinner's book *Verbal Behavior. The Analysis of Verbal Behavior, 9,* 81-96.

Valdman, A. (1975). On the specification of performance objectives in individualized foreign language instruction. *The Modern Language Journal, 59,* 353-360.

Washio, Y., & Houmanfar, R. (2007). Role of contextual control in second language performance. *The Analysis of Verbal Behavior, 23,* 41-56.

Appendices

Appendix A

Log Sheet

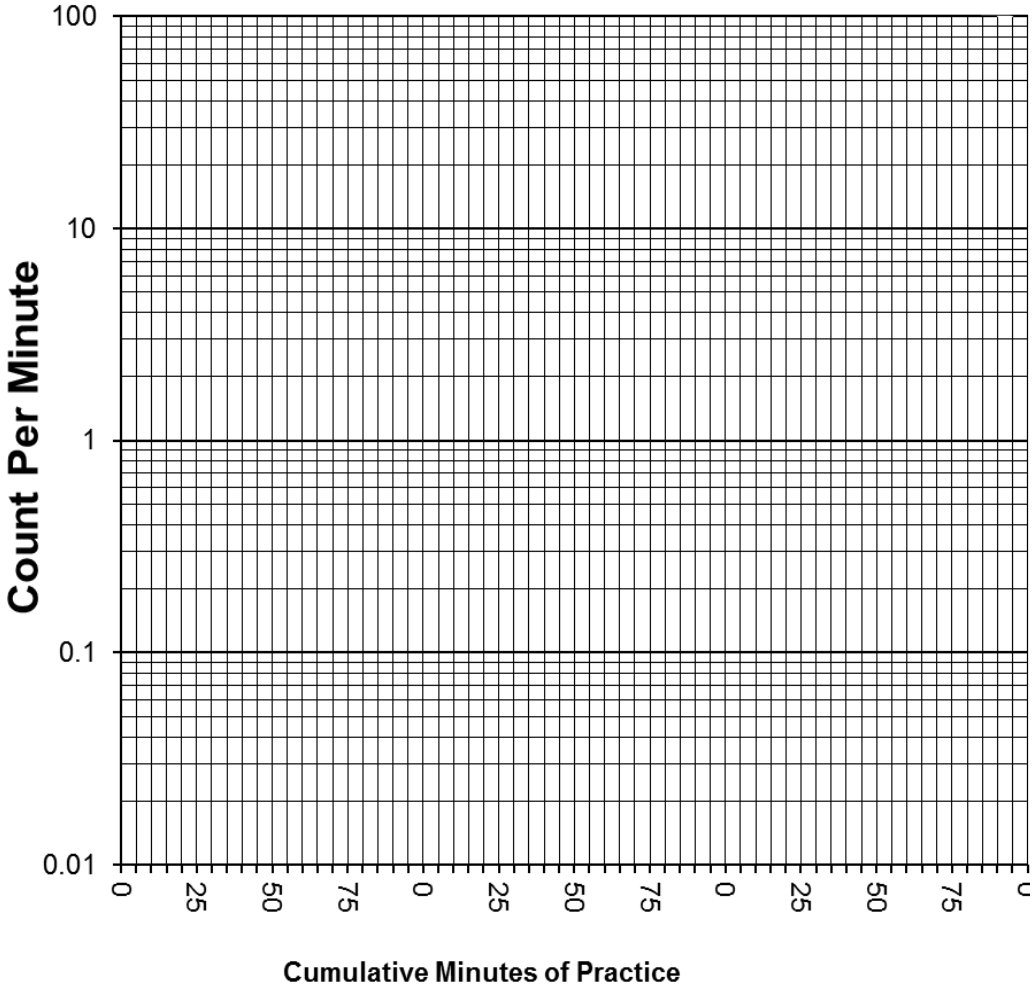
Name _____ Year _____

Date	Unit	Frames Remain-ing	Right or Corrects/ Min	Wrong or Incorrects/ Min	Time in Unit in Min	Cumulative Time in Unit in Min	Independent Test? Yes/No Initials

Appendix B

Cumulative Chart

Name: _____From: ____/____/____ To:



Record Floor in Min	Counting Period in Mins
1.00	1
0.50	2
0.33	3
0.25	4
0.20	5
0.17	6
0.14	7
0.13	8
0.11	9
0.10	10
0.09	11
0.08	12
0.08	13
0.07	14
0.07	15
0.05	20
0.03	30

Appendix C

Recruitment Flyer

Improve your Spanish

Help yourself and others conjugate Spanish verbs.

For first-language English speakers, the conjugation of Spanish verbs is often difficult. To help first-language English speakers learn this skill we are developing software that can teach the accurate and fast conjugation of verbs. Such fluency is not usually produced by current instructional methods.

Although our research focuses on the conjugation of verbs in the past tense, it does not teach conjugating all Spanish verbs. Rather participants will be directly taught to conjugate two verbs from each of three classes of verbs and we will explore whether this skill transfers to six other members of each class. So, particpants may come to fluently conjugate 24 Spanish verbs.

About three students will participate. The study will be conducted at your home, campus computer laboratories, and at the UWM psychology department. We estimate that during the study's main phase you would usually spend about 3 hrs per week on this project for no more than two months. After the main phase is completed, we would like you to return, one month later, for a session of follow-up tests.

This is a substantial time commitment. So, we seek highly motivated persons without this skill who want to improve their Spanish s and who live close to UWM. To further motivate participants we will provide an honorarium of $175 for those who satisfactorily complete all the instructional units and tests.

If you are over 18 years of age and interested please contact Ms. Emily Smedlund at esmedlund@gmail.com. Ms. Smedlund will arrange a meeting in our UWM laboratory.

This research has been approved by the University of Wisconsin--Milwaukee

Institutional Review Board for the Protection of Human Subjects.

Appendix D

Background Survey

Developing Procedures to Help Students Fluently Conjugate Spanish Verbs

Background Questions

1. Alias (Do Not write your name here): _____
2. Age: ____
3. Sex: Male ___ Female ___
4. Highest Level of Formal Education: _____
5. For formal courses you have taken to learn Spanish, please complete this table:

Course Title	Year	Approximate Grade	Where Completed - Check Box		
			High School	College	Other

6. Is there anything more you can tell us about your learning Spanish? For example, did your parents speak Spanish? Did you spend some time in a Spanish-speaking community or country such as Mexico or Spain?

Appendix E

Qualification Test and Consent Form

Study Title: Using Fluency Training to Enhance the Conjugation of Spanish Verbs

Context for This Research: We are developing software to help students conjugate some Spanish verbs in the past tense; for many first-language English speakers this is a difficult skill. The test below will indicate whether you have mastered the skill. If you have not mastered the skill then we will ask you to consider participating in the main phase of our research. That phase requires that you access a computer running a contemporary Microsoft Windows® operating system like XP®, Vista®, or Windows 7 on which our software can be loaded.

The main phase also requires a time commitment of about 3 hours per week for about 2 months. During these 2 months, you would study with the software for about 20 minutes daily, five days per week, and come to our lab twice a week so that we can check on your use of the software and complete tests of progress. After these 2 months, we would ask you to return one month later to complete a final set of tests of your retention of these skills.

If our study interests you, then we would like you to complete the test below. If you are not interested in participating but want a copy of the software for your personal use we will provide a copy and show you how to use it.

Person Responsible for Research: Marshall Dermer, Ph.D., Associate Professor, UWM Department of Psychology

Test Description: On the test you are to conjugate Spanish verbs. You will see short sentences in English and their Spanish translations without the verb endings. For each item we ask that you print the correct ending. With this test we are assessing your current mastery of some Spanish verbs. Completing the test does not obligate you to consent to the main study.

Risks / Benefits: The risks associated with completing the test are minimal and no course credit is offered for completing it. Completing the test may qualify you for the main study where you could improve your Spanish and earn money for participation.

Confidentiality: In completing this test, we will ask you to use an alias. *We will only link your alias with your name and e-mail address if you later consent to the main phase.* Otherwise, the completed questionnaire will be stored in a locked file, in a locked university office indefinitely, and computer records will be stored on password-protected computers indefinitely.

Voluntary Participation: Your completing this test is voluntary. You may choose to not answer any questions and discontinue participation at any time without penalty. Your decision will not change any present or future relationship with the University of Wisconsin Milwaukee.

Who do I contact for questions about the study: For more information about the study or study procedures, contact:

Marshall Lev Dermer, Associate Professor
Department of Psychology
Garland Hall
PO Box 413
Milwaukee, WI 53201-0413
Office: 414-229-6067
Home: 414-332-8606
E-mail: dermer@uwm.edu

Who do I contact for questions about my rights or complaints towards my treatment as a research subject? Contact the UWM IRB at 414-229-3173 or irbinfo@uwm.edu.

Research Subject's Consent to Complete Test:

Completing the test indicates that you have voluntarily agreed to participate, have had all of your questions answered, and that you are 18 years of age or older.

Thank you!

Qualification Test

On this test you will see short sentences in English and their Spanish translations without the verb ending. For each item print the correct ending.

So, when you see an item like this:

1. I moved. Yo mov___.

Just print the verb ending:

1. I moved. Yo mov_í_.

Notice how the ending includes an accent mark. If an accent mark is required then please indicate it as you complete the test.

If you do not know the verb ending please attempt an educated guess. If you cannot make an educated guess, please write an "X" in the space provided:

1. I moved. Yo mov_X_.

You will have 5.5 minutes to complete this test. We will score your responses in terms of correct and incorrect responses /min. We are interested in your both correctly and rapidly translating. Please do not speed up if this will reduce your accuracy. *Try to work at the fastest pace that permits your accurate responding!*

Wait for the signal before turning the page and starting the test.

Qualification Test (sample)

1	I	influenced.	Yo	influ_____
2	They (Linda and April)	talked.	Ellas	habl_____
3	David and I	said.	David y yo	dij_____
4	I	cried.	Yo	llor_____
5	I	contributed.	Yo	contribu_____
6	You (Mr. John)	walked.	Usted	anduv_____
7	I	built.	Yo	constru_____
8	You (singular familiar)	talked.	Tú	habl_____
9	I	wanted.	Yo	quis_____
10	You (Ms. April)	concluded.	Usted	conclu_____
11	You (singular familiar)	rested.	Tú	descans_____
12	They (John and April)	walked.	Ellos	and_____
13	I	built.	Yo	constru_____
14	John and I	took.	Juan y yo	tom_____
15	Linda and April	wanted.	Linda y Abril	quis_____
16	They (Mr. John and Mr. David)	influenced.	Ellos	influ_____
17	You (Mr. John and Mr. David)	talked.	Usteds	habl_____
18	We	walked.	Nosotros	and_____
19	John	influenced.	Juan	influ_____

Appendix F

Instructions for Class 1 Test (original)

For each item on this test, translate the sentence from English to Spanish.

For example, if the item were:

1. I moved.

then you should *neatly* write:

Yo moví.

If the item were:

2. He ran.

then you should *neatly* write:

Él corrió.

Because accent marks are important, be sure to include them in your translations.

Of course you might not at all know the verb, so you might neatly write:

Yo moved.

or if you also know the Spanish root, you might write:

Yo mov__

but omit the ending.

Often, however, you can specify a verb's ending because Spanish verbs fall into classes such that all verbs in a class are conjugated identically. So if you know the endings for one verb in a class and you know that another verb is in that class, you should know the other verb's ending and so you should be able to make an educated guess and write a complete translation:

Yo moví.

Of course, if you cannot even make an educated guess then neatly rewrite the item in English so that all items you attempt to translate are completed.

You will have 2 minutes to complete this test. We will score your responses in terms of correct and incorrect responses per minute. We are interested in your both correctly and rapidly translating. Please do not speed up if this will reduce your accuracy. *Try to work at the fastest pace that permits your accurate responding!*

Wait for the signal before turning the page and starting the test.

Appendix G

Instructions for Class 1 Test (Modified)

For each item on this test, translate the sentence from English to Spanish.

For example, if the item were:

1. I moved.

then you should *neatly* write:

Yo moví.

If the item were:

2. He ran.

then you should *neatly* write:

Él corrió.

Because accent marks are important, be sure to include them in your translations.

Of course you might not at all know the verb, so you might neatly write:

Yo moved.

or if you also know the Spanish root, you might write:

Yo mov__

but omit the ending.

Often, however, you can specify a verb's ending because Spanish verbs fall into classes such that all verbs in a class are conjugated identically. So if you know the endings for one verb in a class and you know that another verb is in that class, you should know the other verb's ending and so you should be able to make an educated guess and write a complete translation:

Yo moví.

Of course, if you cannot even make an educated guess then neatly rewrite the item in English so that all items you attempt to translate are completed.

You will have 2 minutes to complete this test. We will score your responses in terms of correct and incorrect responses per minute. We are interested in your both correctly and rapidly translating. Please do not speed up if this will reduce your accuracy. *Try to work at the fastest pace that permits your accurate responding!*

Wait for the signal before turning the page and starting the test.

Appendix H

Class Test 1 (Sample)

1	John and I	said.	Juan y yo	dijimos
2	I	had.	Yo	tuve
3	You (Ms. Linda and Ms. April)	had.	Usteds	tuvieron
4	You (singular familiar)	came.	Tú	viniste
5	You (April)	wanted.	Tú	quisiste
6	They (Mr. John and Mr. David)	put.	Ellos	pusieron
7	Linda and I	said.	Linda y yo	dijimos
8	You (Linda and April)	had.	Usteds	tuvieron
9	You (Linda and April)	said.	Usteds	dijeron
10	I	wanted.	Yo	quise
11	David and I	came.	Dovid y yo	vinimos
12	You (Mr. John)	put.	Usted	puso
13	I	said.	Yo	dije
14	We	put.	Nosotros	pusimos
15	David and I	had.	Dovid y yo	tuvimos
16	She	wanted.	Ella	quiso
17	You (Linda)	said.	Tú	dijiste
18	I	came.	Yo	vine
19	You (David)	had.	Tú	tuviste
20	You (Mr. John and Mr. David)	said.	Usteds	dijeron

Class Test 2 (Sample)

1	They (Linda and April)	substituted.	Ellas	sustituyeron
2	You (Mr. John)	built.	Usted	construyó
3	They (John and April)	substituted.	Ellos	sustituyeron
4	I	concluded.	Yo	concluí
5	John and David	substituted.	Juan y Dovid	sustituyeron
6	Linda and April	substituted.	Linda y Abril	sustituyeron
7	I	included.	Yo	incluí
8	I	built.	Yo	construí
9	He	included.	Él	incluyó
10	I	contributed.	Yo	contribuí
11	They (Linda and April)	influenced.	Ellas	influyeron
12	I	built.	Yo	construí
13	I	influenced.	Yo	influí
14	You (Mr. David)	included.	Usted	incluyó
15	I	substituted.	Yo	sustituí
16	You(Ms. April)	included.	Usted	incluyó
17	April and John	built.	Abril y Juan	construyeron
18	They (Linda and David)	substituted.	Ellos	sustituyeron
19	She	included.	Ella	incluyó
20	She	substituted.	Ella	sustituyó

Class 3 Test (Sample)

1	They (John and April)	talked.	Ellos	hablaron
2	You (Mr. John)	took.	Usted	tomó
3	You (Linda and April)	talked.	Usteds	hablaron
4	I	rested.	Yo	descansé
5	April and I	took.	Abril y yo	tomamos
6	You (John and David)	talked.	Usteds	hablaron
7	I	cried.	Yo	lloré
8	You (John)	talked.	Tú	hablaste
9	Rose	rested.	Rosa	descansó
10	You (David)	took.	Tú	tomaste
11	I	cried.	Yo	lloré
12	April and I	cried.	Abril y yo	lloramos
13	April and I	talked.	Abril y yo	hablamos
14	They (Linda and April)	smoked.	Ellas	fumaron
15	I	talked.	Yo	hablé
16	She	rested.	Ella	descansó
17	April and I	cried.	Abril y yo	lloramos
18	John and David	rested.	Juan y Dovid	descansaron
19	I	called.	Yo	llamé
20	John and David	called.	Juan y Dovid	llamaron

Mixed Class Test (sample)

1	I	influenced.	Yo	influí
2	They (Linda and April)	talked.	Ellas	hablaron
3	David and I	said.	David y yo	dijimos
4	I	cried.	Yo	lloré
5	I	contributed.	Yo	contribuí
6	You (Mr. John)	walked.	Usted	anduvo
7	I	built.	Yo	construí
8	You (singular familiar)	talked.	Tú	hablaste
9	I	wanted.	Yo	quise
10	You (Ms. April)	concluded.	Usted	concluyó
11	You (singular familiar)	rested.	Tú	descansaste
12	They (John and April)	walked.	Ellos	anduvieron
13	I	built.	Yo	construí
14	John and I	took.	Juan y yo	tomamos
15	Linda and April	wanted.	Linda y Abril	quisieron
16	They (Mr. John and Mr. David)	influenced.	Ellos	influyeron
17	You (Mr. John and Mr. David)	talked.	Usteds	hablaron
18	We	walked.	Nosotros	anduvimos
19	John	influenced.	Juan	influyó
20	I	put.	Yo	puse
21	John and David	cried.	Juan y David	lloraron