DOCUMENT RESUME

ED 430 392 FL 025 825

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TITLE Language Gains During Study Abroad: A Reassessment of the "Predictors Study" and Prospects for Future Research.
PUB DATE 1998-12-00
NOTE 32p.; Paper presented at the Annual Meeting of the American Association of Teachers of Slavic and East European Languages (San Francisco, CA, December 1998).
PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Achievement Gains; Educational Research; Higher Education; *Language Proficiency; Language Research; Language Skills; *Predictor Variables; *Research Methodology; Second Language Learning; *Second Languages; Statistical Analysis; *Study Abroad

ABSTRACT

The paper considers the effects of study abroad on student second language acquisition (SLA) and suggests areas for further study. It begins with an overview of current research on study abroad, its relationship to foreign language programs, and the innovations that this growing research base holds for program development. Attention then turns to Russian language teaching and the 1993 study, "Predictors of Foreign Language Gain During Study Abroad" (Predictors study). Discussion focuses on the compatibility of data analysis results with interpretations and implications for second language learning, instructional materials, and program development. The questions raised in this discussion lead to the final section: prospects for increasing understanding of the role of study abroad in the teaching and study of the Russian language. In this section, strategies are suggested for strengthening existing predictor models, study designs, questions to be addressed, and variables that might lead to an increased understanding of SLA during study abroad and the pragmatic applications for designing optimal study abroad experiences. Contains 35 references. (MSE)

Language Gains During Study Abroad: A Reassessment of the "Predictors Study" and Prospects for Future Research

Paper Presented at the Annual Meeting of the American Association of Teachers of Slavic and East European Languages, San Francisco, December, 1998

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This abstract may be used or may supplement the accopanying ERIC abstract - J. Watzke

Abstract

The purpose of this paper is summarized by three goals.

1) to provide an overview of research on the benefits and optimal conditions for the study abroad experience;
2) to review the analysis of ACTR data on study abroad and assess its interpretations and implications for SLA and programmatic and instructional planning;
3) to support the continuation of this research agenda through the recommendation of data analysis strategies, research questions, and the formulation of predictor variables.

This paper will begin with an overview of current research on study abroad, its relationship to foreign language programs, and the innovations that this growing research base holds for programmatic development. The focus will then turn to the Russian language teaching profession and the landmark "predictors" study. This discussion will focus on the compatibility of the results of data analysis with interpretations and implications for SLA and materials and programmatic development. The questions raised during this discussion will lead to the final portion of the paper—prospects for increasing our understanding of the role of study abroad in the teaching and study of Russian language. This section will suggest strategies for strengthening existing regression (predictor) models, study designs, questions to be addressed, and variables which might lead to an increased understanding of SLA during study abroad and the pragmatic applications for designing optimal study abroad experiences.

Language Gains During Study Abroad: A Reassessment of the "Predictors Study" and Prospects for Future Research

Introduction

Research on the benefits of study abroad, particularly as it relates to second language acquisition (SLA) in Russian, has received little attention in research literature until recently (Burn, 1986, p. 183-184; Dekeyser, 1991, p. 104-106). The publication in 1993 of "Predictors of Foreign Language Gain during Study Abroad" (from this point referred to as the "Predictors Study") provided a summary of previous studies and the necessary data analysis, interpretations, and ensuing questions to support a research agenda on study abroad as it relates to second language acquisition (SLA), materials development, and the timing and quality of these programs (Brecht, Davidson, and Ginsberg). Indeed, in the body of contemporary literature on study abroad, the "Predictors Study" is now cited as frequently, if not more so, than Carroll's milestone 1965 study relating college-level foreign language achievement to study abroad. The research base has grown remarkably in the past decade as numerous follow-up studies, both quantitative and qualitative, have further investigated its findings or pursued new directions on this topic (to name a few: Brecht and Robinson, 1995; Miller and Ginsberg, 1995; Polanyi, 1995).

This presentation will return to the original series of analyses summarized by the "Predictors Study" to propose additional analysis strategies and research questions which may provide insight into the SLA process and related programmatic and policy issues. I have intentionally entitled this presentation a "reassessment" because I believe that the results of the "Predictors Study" are

open to interpretation and the database rich enough to provide continued analysis. This reassessment benefited from the correspondence and input of Ralph Ginsberg who conducted much of the data analysis for the original study.

Study Abroad Research: Optimal Time and Benefits

Why should the profession be interested in study abroad? Perhaps the most common answers to this question is that since the late 1980s there has been an increase in opportunities for students of Russian at the high school and college levels to include study abroad in their academic programs and that study abroad contributes to the attainment of advanced-level proficiency. Research on language gains during study abroad has the capability to inform our profession not only on its benefits, but also the underlying second language acquisition process. Table 1 (in your handouts) presents a summary of studies from the 1980s through the 1990s. These represent a variety of foreign languages, modalities of interest, preprogram levels, assessment instruments, and results. They highlight the advantages of study abroad over traditional or in-country immersion learning. They speak to the programmatic issues of optimal time for initiating such programs and the potential benefits of study abroad at varying preprogram levels of proficiency. They also provide insights into the underlying SLA process and the complexities of using global rating scales in this research. While the remainder of this presentation will focus on the "Predictors Study", this growing research base will support this discussion.

The "Predictors Study":

The Analysis of Data on Gains in Russian

"Predictors of Foreign Language Gain During Study Abroad" is based on an exploratory analysis of numerous pre-program variables and measures of language skills. Its conclusions draw primarily from a series of regression analyses (Ginsberg, 1992; Ginsberg et al., 1992). In this study, variables were tested to see which combination best predicted language gain after study abroad in the modalities of listening, reading and speaking.

Regression allows for the forming of models, or sets of independent (or predictor) variables, to obtain an equation used to predict changes in the dependent variable. It is used in research for one of two goals. First, for descriptive or explanatory purposes, regression identifies and compares the level of contribution of individual variables that comprise a regression model. Central questions to ask when examining each model are to what extent individual variables contribute to the model, what are their strengths vis-à-vis one another, and what criteria was used to include or exclude variables from the model. The answers to such questions are vital when discussion moves from considering the entire model to an individual variable and its implication for further research and policy decisions.

Second, for the purpose of prediction, regression analysis obtains an equation or model that predicts changes in the dependent variable with as little error as possible (Affifi and Clark, 1990, p. 187-188). As Affifi and Clark (1990) point out in their discussion on evaluating regression analyses, ultimately, we should be able to trust the predictions made by a regression model. In other

words, can the set of variables in a model correctly predict the dependent variable a high proportion of the time (p. 326)?

[Place Figure 1 approximately here]

In the "Predictors Study", regression model one, for example, included eight variables that predicted gains in listening after study abroad. Such variables ranged from gender to scores on tests of reading. Model three, on the other hand, predicted whether or not students gained or did not gain in oral proficiency. Five predictor variables were retained in this model ranging from whether or not a student had studied Russian in high school to scores on a qualifying grammar and reading test. Examining the models in figure 1, not only do we want to know to what extent individual variables contribute to the predictive ability of the model, ultimately it is important to ask the question of whether a model predicts language gains reliably and accurately.

These questions go beyond statistical significance of the model or individual variables,because these can be significant even when the model offers no practical predictive ability (Affifi and Clark, p. 326). Hosmer and Lemeshow further suggest that any interpretation of a regression model should be preceded by an assessment of the adequacy of the fitted model to predict and classify subjects correctly (1989, p. 38).

In linear regression, model strength, or the ability of the model to predict, can be gauged by the coefficient of determination (or R squared). The R squared describes the proportion of variance associated with differences in the independent variable or set of variables. In other words, the R squared value

gives a measure of the proportion of gain in a foreign language modality that is explained by the variables in the regression model. Figure 2 presents a graphical depiction of the linear regression models for gains in listening and reading from the "Predictors Study."

[Place Figure 2 approximately here.]

In the model for listening, the R squared is .418 which indicates that the eight variables in the model account for 42% of the gain in listening as measured by the ETS test. On the other hand, 58% of this gain is accounted for by some unknown variable or variables. The prediction model for reading is somewhat weaker. Its R squared is .215 indicating that the five variables in its model can only account for 22% of gain in reading. In terms of predictive ability, the model for reading seems to be quite weak. The listening model, while stronger, still accounts for less than half of the gain after study abroad.

[Place Figure 1 approximately here.]

Comparing the regression models for listening and reading to speaking, similar R squared values are found. The regression analyses of gain in oral proficiency utilized logistic and probability unit regression. In these analyses the dependent variable was not linear but represented dichotomously coded categories (gain or no gain, gain of two, one or no levels). While R squared is not an accepted measure of model strength for logistic and probability analyses (Aldrich and Nelson, p. 57; Afifi and Clark; Hosmer and Lemeshow, 1989, p.

106,135), it is the only measure of model strength provided with these analyses and it allows for general discussion of the predictive ability of these models.

With respect to second language acquisition research, these low R squared values are not surprising. The Carroll study of 1965 reported R squared values ranging from approximately .19 for Russian to .44 for French in regression models predicting MLA listening scores (calculated from 1967, p. 149, Table 7). Similarly, research on foreign language aptitude and motivation has also failed to provide stronger regression models (Bialystok and Hakuta, 1994, p. 126-134; Hancock, 1972). The low R squared may be an indicator of the complicated nature of the research question under study. Processes as complex as language acquisition cannot be explained by a limited number of variables. In the case of the logit and probit models in Figure 1, the lack of a linear dependent variable also complicates the issue of model strength.

Given the predictive ability of each model, how do we judge an individual variable's contribution to the model? Do all variables in a model affect language gain equally? This is a complex issue due to intercorrelations among variables, but one which is important to the interpretive process.

[Place Figure 1 approximately here.]

Focusing on one variable, such as gender in model five in Figure 1, forces the question of relevance of this variable as a single issue. Based on the model R squared we know that if we attempt to use the five predictor variables <u>together</u> in model five to predict whether students gain or do not gain into advanced levels, our predictions would be wrong most of the time. In order to single out one of

these variables and judge whether it should stand alone as a relevant issue for interpretation, knowledge of its individual contribution to the predictive ability of the model is helpful. Affifi and Clark, Bernstein, and Johnson and Wichern describe various approaches for determining the contribution of individual variables. Figure 3 provides an example of only one approach — that being the technique of forward selection regression (Afifi and Clark, p. 196-203). Similar techniques include backward elimination and stepwise procedures.

[Place Figure 3 approximately here.]

This figure presents the table summary of a linear regression model of twenty-five independent variables predicting cumulative years studied of foreign language by high school seniors. The results provide important information beyond significance. The change in R squared is determined as each variable is added to create a new model. In the case of this analysis, although twenty-five out of over forty original independent variables are significant at the .05 level, the contribution beyond the eighth variable (or eighth model) to the adjusted R squared is less than one percent. Thus, beyond variable eight, any contribution to the model from subsequent significant variables may be considered too small to be meaningfully interpreted. This technique addresses the "positive bias" associated with R squared (Bernstein, 1988, p. 102). Rather than regarding the maximum or largest R squared possible as the criteria for model building, the individual contribution to the model of significant variables is now the criteria. Several alternative approaches exist which allow for model building based on this idea (Afifi and Clark, p. 203-204; Johnson and Wichern, 1998, p. 408-409). Once

a parsimonious model is determined, comparing the standardized beta coefficients (provided as a regular output option from statistical programs) would allow the researcher to directly compare the proportionality of strength of significant variables to one another. Ultimately, when discussion moves from exploratory findings to single variables, it is advantageous to explore the contributions and strength of these variables.

A final aspect of variable selection relevant to this discussion is the use of pre-test scores as independent variables as a controlling strategy.

[Place Figure 1 approximately here.]

In the first four regression models for listening, reading and oral proficiency in Figure 1, the strongest variable (in terms of the t-statistic) is the pre-test score of that modality. Boxed in Figure 1, for example, for listening model 1, the pretest score on the ETS listening test is the strongest predictor for gain on the post-test listening dependent variable. This also holds for the reading and first two OPI models. Notice that in each model not only does this pre-test have the highest t-statistic, but it is always negatively associated. The higher a student scores on a pre-test, the less gain on the post-test dependent variable. There seems to be differing opinions among researchers as to pre-test/post-test regression designs. I would like to suggest three reasons for considering alternative controlling strategies.

1. Mathematically, pre-test independent variables will always be significant and negatively associated with the post-test dependent variable (C. Deville and H. D. Hoover, personal communication, August-September, 1998). Control of this variable is recommended to address its confounding affects. However, this control does not require its inclusion in the set of independent variables.

2. In the general research questions outlined in this study, pre-test scores as a predictor were not specified for inclusion and the information they provide is limited to describing ceiling effects common in assessment.

3. By including pre-test scores, model strength in terms of the R squared is inflated. While removal of this pre-test variable will undoubtedly decrease the R squared to below .40 in the listening model and below .20 in the other three models, model strength is more precisely gauged. In addition, in the forward selection technique outlined above, excluding this pre-test variable may lead to the inclusion of additional variables during the selection process and change the final model outcome.

Model five, the final model in Figure 1, provides an example of control for pre-program ratings while excluding this variable from the analysis. In this model a subpopulation (those students who had pre-test OPI ratings of 1+) was selected for analysis. This, in effect, controlled for differences in pre-test ratings and also served to narrow the focus of the research question to those students most likely to gain into the advanced level. Such narrowly focused research questions are

more easily formulated because of the exploratory work and findings provided by the original "Predictors Study."

Findings From the Predictors Study and Their Implications for Policy, Planning, and Research

To conclude, I would like to propose several questions and analysis techniques utilizing the existing ACTR database to investigate the underlying SLA process during study abroad and related issues of programmatic policy and planning.

1. When should students study abroad? This seems to depend on the goal. In terms of achieving advanced oral proficiency, research in French, Russian, and Spanish suggest that only those students with pre-program OPI levels of intermediate high (or I +) are most likely to gain into the advanced level after one semester of study abroad (Ginsberg, 1992; Liskin-Gasparro, et al., 1991; Milleret, 1991). Studies conducted by Thompson (p. 51, Table 3) and Ginsberg (p. 30, Table 6) suggest that if students of Russian initiate study abroad during their junior or senior years, after only two-three years of college-level study, the majority can be expected to have a pre-program OPI rating of intermediate low or lower. It is only after four or more years of college level study will a larger proportion of students, although not necessarily the majority, be in a position to initiate study abroad at the intermediate high level (or 1+). Consequently, undergraduate level study abroad with the goal of achieving advanced level proficiency may be impractical without previous immersion or intensive language study, summer session study and possibly prior study at the high school level. Ginsberg provides some evidence that previous immersion and high school level

study predicts general gain in oral proficiency during study abroad (p. 40, Table 17). However, of these two variables, only high school level study of Russian predicts gain from intermediate high to the advanced level or higher (p. 43, Table 21). In light of national high school-to-college articulation and K-16 Standards efforts, the further study of the contribution of pre-college study of Russian to advanced level proficiency is warranted. Thus, this database allows for opportunities to study language development and issues before study abroad. Comparative chi-square analysis controlling for high school and years of college study and previous immersion would reveal whether a significant proportion of students with pre-program intermediate high ratings are those with specific types of learning histories. Such analysis could further investigate the extent to which specific learning histories contribute to gains into the advanced level with implications for planning high school and college program sequences leading to study abroad.

2. The pre-test OPI variable is unique among the independent variables. This ordinal variable, as described by Ginsberg (p. 12), represents several categories of proficiency that are not distinguished by a consistent interval scale. Recoding pre-program OPI into several dummy variables may provide more precise results for interpretation. Rather than one general ordinal OPI variable, recoding it into several dummy variables representing pre-program level 1 (yes or no), level 1 + (yes or no), and so on, may provide specific information on levels crucial to regression models or other analyses. This procedure is also warranted in the case of linear regression in which ordinal variables are recommended to be recoded. Afifi and Clark (p. 225-226) and Bernstein (p. 123-127) discuss techniques for

including categorical and ordinal variables in linear regression and various approaches to creating dummy variables.

3. The issue of gender was purposefully mentioned earlier in this paper because it is a current topic in the discussion of acquisition during study abroad. The "Predictors Study" and a similar German language study described in Carlson et al. (1991) found that being male predicts language gains under certain conditions. Is the proportion of men who gain into the advanced level higher than that of women? Splitting the study population by gender, what variables explain those women who gain into advanced proficiency and those who do not? Are the regression models similar for men who do and do not gain? What underlying variables does gain share with both genders? Considering the total population, what variables explain those women who surpass men in terms of language gain? All of these questions can follow up the original finding of the "Predictors Study". They address the weak predictive ability of the regression models by demonstrating consistency in findings across multiple analyses and sub-groups. In addition to basic t-tests and chi-square analysis, cluster analysis might be explored as a means for determining the prototypical woman, man and non-gender-specified student who gains and does not gain according to established criteria. Cluster analysis may also investigate all variables and students simultaneously to determine the naturally occurring taxonomy or prototypes of students engaging in study abroad and to identify pre-program issues or variables which prohibit gain and to describe those students who demonstrate resiliency despite debilitating variable values. The breaking up and contrasting of variables

and the narrowing of research questions is a natural progression from exploratory analysis of whole or intact variables and demographic categories.

4. Finally, the "Predictors Study" is one of only a few studies to investigate gains after study abroad in several language modalities. The ACTR database provides the opportunity to compare models of second language acquisition not only across levels of proficiency, but also across modalities for the same students. Grammar/reading knowledge was shown to be consistent across all modalities — a finding which, it was suggested, "is particularly important to teachers and textbook designers" (Brecht et al, 1993, p. 21). The fact that this variable was consistently retained addresses the low predictive ability of these models and supports the intuitive idea that grammar is fundamental to language gain, particularly into advanced levels. As for implications for pedagogy and materials development, this variable is more controllable than many of those that are demographic in nature and may indeed inform practice. Since we have no indication of its strength or affect on gain in comparison to other variables with planning and policy implications, such as previous immersion and high school study, it would be worthwhile to investigate these comparisons. An important question this database might answer is exactly how much grammar knowledge, that is, what threshold level on the grammar test, is sufficient to gain into advanced-level proficiency and what kind of language learning histories do students have that allow them to acquire this knowledge before initiating study abroad. Viewing variables not as whole entities, but as potentially many variables to be contrasted takes advantage of the multiple perspectives this database offers for investigating second language acquisition.

Conclusion

Beyond these questions, is the potential for future research, based in part or wholly on this database, to inform the profession on issues relating the role of study abroad to articulation, pre- and in-service teacher development and the planning of effective instructional programs. My interests are particularly aimed at these three areas. It is my hope that this "reassessment" will help to continue the dialogue and research on study abroad.

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Table 1. Optimal time and gain during study abroad: Summary of studies limited to American students in study abroad settings from 1984-1998[1].

Author(s)	Subjects (time abroad)	Assessment Method	Summary of Findings
Freed (1995)	• 15 college students of French; 15 students as control group • various levels • (one semester)	• OPI • 1-7 scale of fluency rated by 6 native speakers using pre-/post-OPI speech samples • linguistic analysis of 8 students' speech samples	• Overall gain in OPI an advantage for the study-abroad group • No significant difference was found between the two groups in terms of fluency (t and X^2 tests) • Students with pre-program fluency ratings below 4 (out of 7) gained significantly more in fluency than the control group • Rate of speech was significantly higher for the study abroad students • Other trends cited without significance (possibly due to low n)
Huebner (1995)	• 10 college students of Japanese; 12 students as control group • first-year summer intensive study • (nine weeks)	• ETS Japanese proficiency test (JPT) • OPI • narrative retelling • survey of learning strategies • observations; interviews; diaries	• Mean post-program OPI was Inter. High for study abroad and Inter. Mid for at home • Abroad group showed biggest gain over at-home group in JPT reading sub-test • Abroad group produced more text in narrative retelling (pragmatic competence) • Abroad group favored "Learning with others" learning strategies
Lafford (1995)	• 13 college students of Spanish in Mexico and 16 in Spain; 13 control group students • beginning level designed to cover first 4 semesters of language courses • (one semester)	• OPI • assessment instrument of communicative strategies used during interviews	• The study abroad group: 1) utilized a broader repertoire of communicative strategies 2) produce more words during the OPI 3) is suggested to have gained in "communicative competence" • The "quantitative" analysis of data did not include statistical analysis
Liskin-Gasparro & Urdaneta (1995)	• 9 college students • 1 year college Spanish completed • (one semester)	• OPI	• Novice pre-program reach Inter. Mid • Inter. Mid pre-program reach Inter. High Anecdotally: • Tendency for non-major participants to declare major/minor • Sp. majors elect graduate coursework upon return

Table 1. (Continued)

Author(s)	Subjects (time abroad)	Assessment Method	Summary of Findings
Ginsberg (1992)	• 658 college students of Russian • various years of pre-program study (mode = 3) • (four months)	• OPI • ETS battery • MLAT battery • ACTR qualifying exams	• In terms of OPI: 1) pre-OPI, HS Russian, nonSlavic language, pre-ETS listening and reading, major, and program date were significant predictors for gain at all pre-program OPI levels 2) gender (=male), HS Russian, Slavic and nonSlavic languages, and the ACTR general qualifying exam were significant predictors when pre-program OPI was controlled for 1+ • In terms of ETS reading: 1) pre-ETS reading, gender (=male), pre-ETS listening, MLATSF, and the ACTR qualifying reading exam were significant predictors • In terms of ETS listening: 1) pre-ETS listening, gender (=male), age, HS Russian, NonSlavic language, previous immersion, pre-ETS reading, and MLAT3 were significant predictors
Ginsberg, Robin & Wheeling (1992)	• 82 college students of Russian • various years of pre-program stuy • (four-ten months)	• student self-assessment of listening skills • ETS listening test	• In terms of gains in listening comprehension after study abroad: 1) majority of students felt they gained in all listening situations 2) only pre-program self-assessment was a significant predictor of post-program self-assessment 3) pre-ETS and practice with taped-texts were significant predictors of the post-ETS listening test (Educational factors) 4) Gender(=male), nonSlavic languages, EST reading were significant predictors of post-ETS listening (Non-educational factors)
Carlson, et al. (1991)	• 102 French and 69 German college majors • junior year abroad • (one year)	• ETS self-appraisals in reading, writing, speaking, listening • OPI	• Pre-/post-OPI for 37 German students alluded to gain into advanced levels (missing data; design problems) • Regression analyses predicting cumulative gain in combined self appraisals: - identified 7 sig. predictors for pre-program variables; gender (male) was strongest - identified 4 sig. predictors for in-country variables; degree of integration into host country was strongest • Regression analyses reported anecdotally

Table 1. (Continued)

Author(s)	Subjects (time abroad)	Assessment Method	Summary of Findings
Liskin-Gasparro, Wunnava & Henry (1991)	• college majors of Spanish and Russian • junior year • (one-two semesters)	• OPI	• Post-program OPI of Adv. or Adv. High associated w/ one or more: 1) long learning history w/ 4 yr. high school and upper-level college courses 2) pre-program OPI of Inter. High 3) full year study abroad
Milleret (1991)	• 11 college students of Portuguese (2 native Spanish speakers) • subjects had completed 2-6 sem. of study • (5-week summer study)	• Portuguese Speaking Test (PST) developed by CAL as a pre-recorded oral interview	• Curriculum of 5-week program tailored to information from pre-test scores and deficiencies • Mean gain was approximately from Inter. Mid to Inter. High • The lowest rated grouping of students gained the most; from mean Novice Mid to Inter. Low • The highest rated grouping gained the least; "just below" mean Inter. Mid to "just above" Inter. Mid • High pre-test scores of native speakers may have skewed these results
DeKeyser (1986 reported in 1991)	• 7 students of college Spanish experimental group; 5 college students control group • all had completed two-year sequence; groups controlled my MLAT • (six months)	• grammar test • interviews and picture descriptions focusing on grammar points and compensation (communicative) strategies	• Between groups, no statistical difference in use of strategies or monitoring behaviors • Within the study-abroad group, individual differences were present • Differences in use of monitoring and communicative strategies may affect the way native speakers perceive and seek our or avoid non-native speakers
Baker (1985)	• 224 college non-majors studying German; matched control group • beginning level • (6 months)	• academic achievement • post-program foreign language enrollments	• Non-majors with early study abroad complete third-year level upon returning by a factor of 3 to 1 • No sig. difference in additional declared majors • Overall GPA remained same after program
Vaguez (1984)	• majors of college Spanish returning from junior year abroad • (one year)	• OPI	Anecdotally: • Although students demonstrate gains in OPI, grammatical competence may stagnate or atrophy • Gains in OPI may not capture persistent grammatical problems • Writing skills of students did not improve after study abroad

[1]The reader is urged to consult the original studies for a full description of their methodologies and findings.

Figure 1. Summary of "predictors study" results. Final (or "good") regression models affecting gain during study abroad: Listening, reading, and speaking.

Variable	Model 1 ETS Listening	Model 2 ETS Reading	Model 3 OPI (0/1)	Model 4 OPI (0/1/2)	Model 5 OPI 1+ to 2↑
Gender	2.04	—	—	—	2.84
Age	-4.25	—	—	—	—
High school Russian	-1.68	—	2.03	2.23	1.72
College Russian	—	—	—	—	—
Slavic languages	-1.60	—	—	—	1.99
Non-Slavic languages	—	—	—	1.48	1.96
Previous immersion	2.23	—	—	—	—
Major	—	—	—	2.13	—
Program date	—	—	-3.55	-3.93	—
MLAT3	4.45	—	—	—	—
MLAT4	—	—	—	—	—
MLAT5	—	—	—	—	—
MLATSF	—	6.73	—	—	—
QualGram	—	—	—	—	—
QualRead	—	3.40	—	—	—
QualGen	—	—	2.00	2.16	2.60
ETSL1	-16.50[a]	1.66	—	—	—
ETSR1	7.80	-8.98[a]	2.48	2.40	—
OPI1	—	—	-9.04[a]	-9.72[a]	—
Model R^2	**.418**	**.215**	**.231[b]**	**.251[b]**	**.212[b]**

Notes. Table adapted from Brecht, Davidson and Ginsberg (1993, Table 11).

[a]Represents a pre-test (independent)/post-test (dependent) confounding variable.

[b]Logistic and probability regression model. R^2 is not generally considered an appropriate means for judging model strength or predictive ability.

Figure 2. Graphic representation of the coefficient of determination (R square) for the listening (n = 563) and reading (n = 563) linear regression models in the "predictors study."

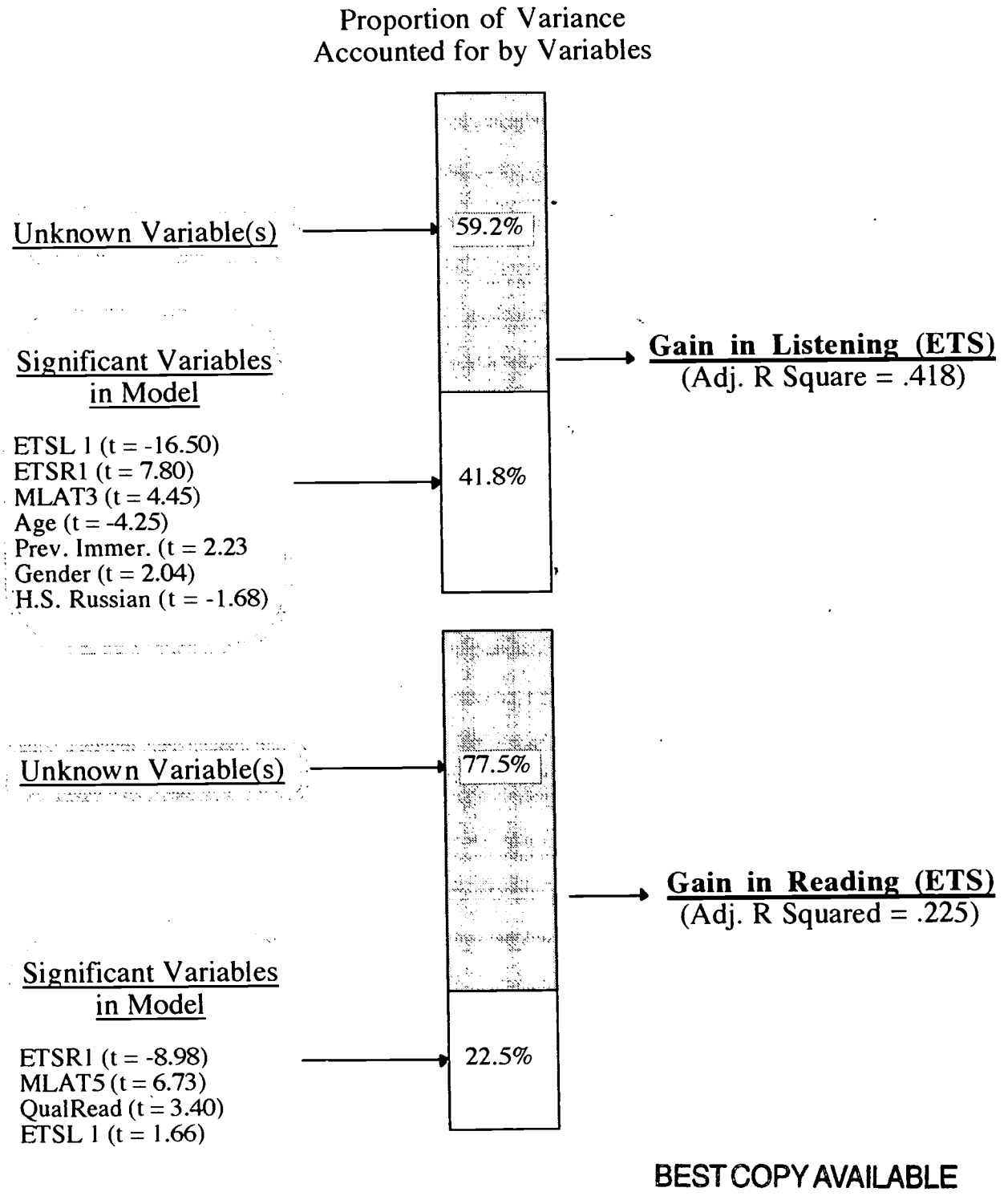

Figure 3. Example forward selection linear regression output: Model summary table listing adjusted R squared change for each additional significant variable. Twenty-five variables predicting cumulative years studied of foriegn language (12th grade, n = 14,096).

Model Summary

					Change Statistics			
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.478	.229	.228	1.2250	.229	1100.602	1	3714	.000
2	.544	.295	.295	1.1709	.067	352.370	1	3713	.000
3	.579	.335	.335	1.1374	.040	222.890	1	3712	.000
4	.601	.361	.360	1.1153	.026	149.722	1	3711	.000
5	.619	.383	.382	1.0964	.022	129.480	1	3710	.000
6	.634	.401	.400	1.0798	.019	116.158	1	3709	.000
7	.646	.417	.416	1.0658	.016	99.090	1	3708	.000
8	.654	.428	.427	1.0560	.011	69.972	1	3707	.000
9	.661	.437	.435	1.0479	.009	58.718	1	3706	.000
10	.666	.444	.442	1.0412	.007	48.644	1	3705	.000
11	.669	.448	.446	1.0380	.004	24.195	1	3704	.000
12	.671	.451	.449	1.0353	.003	20.337	1	3703	.000
13	.674	.455	.453	1.0314	.004	29.272	1	3702	.000
14	.676	.457	.455	1.0295	.002	14.531	1	3701	.000
15	.678	.459	.457	1.0276	.002	14.919	1	3700	.000
16	.679	.461	.459	1.0258	.002	13.989	1	3699	.000
17	.680	.463	.460	1.0246	.001	9.525	1	3698	.002
18	.681	.464	.461	1.0236	.001	8.182	1	3697	.004
19	.682	.465	.462	1.0227	.001	7.397	1	3696	.007
20	.683	.466	.463	1.0219	.001	6.709	1	3695	.010
21	.683	.467	.464	1.0213	.001	5.692	1	3694	.017
22	.684	.467	.464	1.0208	.001	4.508	1	3693	.034
23	.684	.468	.465	1.0204	.001	4.043	1	3692	.044
24	.685	.469	.465	1.0199	.001	4.449	1	3691	.035
25	.685	.469	.466	1.0195	.001	3.965	1	3690	.047

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