

# **EFFICIENCY OF APPLICATIONS AND COURSES FOR LANGUAGE LEARNING AMONG METU STUDENTS**

FINAL PROJECT REPORT SUBMITTED  
IN FULFILMENT OF THE REQUIREMENTS FOR THE COURSE  
STAT 365 – SAMPLING AND SURVEY TECHNIQUES

DEPARTMENT OF STATISTICS OF  
MIDDLE EAST TECHNICAL UNIVERSITY

BY

Buse Uzun

Elif Ekici

Yeşim Sıla Pekşen

JANUARY 2024

## Table of Contents

Abstract.....	3
1. Introduction.....	3
1.1. Data description.....	4
1.2. Research questions.....	5
1.3. Aim of the study.....	6
2. Methodology.....	
3. Analysis.....	
4. Results.....	
5. Conclusion.....	
References.....	
Appendices.....	

## ABSTRACT

The importance of learning languages is rapidly increasing day by day. Simultaneously, the learning methods are also varying. Therefore, the question of which learning methods are more efficient became an important issue. Hence, the aim of this project is collecting data and analysing it to investigate the answer to this question.

The data was collected among METU students who learn a foreign language except English. Students were asked which applications they use or courses they attend, how much time they spend on a weekly basis and in total, whether they need to learn a new alphabet, and how they rate the efficiency of the application/course.

For the analysis, hypothesis testing and Poisson regression were conducted. As a result, the average efficiency of applications and courses is not significantly different. The average learning progress differs significantly depending on the total spent time. The average learning progress does not change significantly according to other factors such as, weekly spend time, learning a new alphabet, and learning methods.

## **1. Introduction**

In the modern world, language learning gained a critical place in people's lives. There are many aspects of knowing a foreign language that can transform your life to have a different world vision and opportunities. Louis von Ahn (April, 2023), states that knowing a language makes it possible to earn more money. For example, if you are a waiter who knows English, you can get employed by an international luxurious hotel and you can make more money. As Ahn (2023) states, language learning brings you to an upper stage, not only in business life but also in academic and social lives.

According to Louis von Ahn (April, 2023), there is approximately two billion people in the world learning a foreign language, which is an enormous number. This means that a noticeable amount of the population consists of foreign language learners and this number is gradually growing. Hence, in this project we investigated the effectiveness of language learning methods

because it requires a generous amount of effort and time. Therefore, before spending too much time on the ineffective methods, learner can choose the most efficient path of language learning. The aim of this project is to show people which learning approach is more effective in terms of progress levels (beginner, elementary, intermediate, etc.) and user feedback about the efficiency of the chosen method.

### **1.1.Data description**

There are 15 variables in the collected dataset. Sample size of the dataset is 285, and 5 of these observations are removed due to irrelevant answers to the questions. Therefore, final sample size of the study is 280 observations.

The dataset contains; year of birth, gender, education level, department, language, learning method, application name, course name, starting level, current level, total time, weekly time, efficiency, skill, alphabet.

- Year of Birth: Ranges between 1978 and 2005. This is a continuous variable.
- Gender: Female, male, prefer not to say, or non-binary. This is a categorical variable.
- Education Level: This variable represents in which year the students are, or if they are a graduate student. This is a categorical variable.
- Department: This is a categorical variable.
- Language: This variable represents which language is being learned except English. This is a categorical variable.
- Learning Method: This variable shows what is the chosen learning method of the participant. This is a categorical variable. These two categories are application and course.
- Application Name: Name of applications used by application users. This is a categorical variable.

- Course Name: Name of courses used by course attendants. This is a categorical variable.
- Starting Level: Language level which participants starts from. This is a categorical variable. These categories are beginner, elementary, pre-intermediate, intermediate, upper-intermediate, advanced, proficient/fluent.
- Current Level: Language level which participants are currently in. This is a categorical variable. These categories are beginner, elementary, pre-intermediate, intermediate, upper-intermediate, advanced, proficient/fluent.
- Total Time: Total amount of spent time in language learning. This is a categorical variable. This variable contains 7 categories: 0-3 months, 4-7 months, 8-11 months, 12-15 months, 16-19 months, 20-23 months, 2+ years.
- Weekly Time: Weekly total amount of spent time in language learning. This is a categorical variable. This variable contains 5 categories: 0-1 hour, 2-3 hours, 4-5 hours, 6-7 hours, 8+ hours.
- Efficiency: How the participant rates the used learning method from 1 to 5. This is a discrete variable.
- Skill: Specifically which skill the participant wants to improve by using the learning method. This is a categorical variable. This variable consists of speaking, listening, writing, reading, vocabulary, or all the above skills.
- Alphabet: Whether the participants need to learn a new alphabet for the studied language. This is a categorical variable.

## **1.2. Research questions**

Language learning is an important aspect of today's world. Whereas face to face learning was demanded on previous decades, there appeared many options for learning languages, especially in this technological era, such as online applications, social platforms, so on.

Therefore, in this project the efficiency of language applications and courses are compared and examined among Middle East Technical University (METU) students.

### **1.3.Aim of the study**

The aim of this study is investigating the effectiveness of online applications and courses among METU students. Moreover, how the learning process is related with some factors, i.e. total spent time, weekly spent time, alphabet learning etc. is examined. This study is expected to show that courses are more efficient than online applications as it is a well-accepted and rooted method.

## **2. Methodology**

The population of the study is METU students who are learning a foreign language other than English. However, the exact number of foreign language learners in METU is not known. Therefore, calculations are conducted with the population size of enrolled students in METU and result is reduced afterwards.

There are 26451 enrolled students in METU. Since population parameters are unknown, population proportion is taken as 0.50, margin of error is taken as 5%, and confidence interval is selected as 95%. In conclusion, sample size is calculated as 379, and reduced to 285 as the corresponding population size is lower than the entire enrolled students.

Sampling methods of the survey are simple random sampling and convenience sampling. Survey (Figure 5) was conducted face to face by using forms, and questionnaire type is structured with multiple choice and open-ended questions. Survey (Figure 5) was created on Google Forms. Since RStudio has advanced data visualization and analysis features, RStudio was utilized for analysis, data mining, and visualization.

## **3. Analysis**

Since one of the aims of the project is comparing the effectiveness of online applications or courses, hypothesis test was conducted to analyse whether the means of efficiency of chosen

method differs from each other. Two-sided hypothesis test was conducted with 95% confidence interval. Since the population variance is not known, sample variance of courses and apps was calculated as 1.032038 and 0.7241379 respectively. Therefore, variances were not taken equal.

Another aim of the project is examining how the learning progress is affected by some factors such as total learning time, weekly learning time, and learning a new alphabet. As shown in box-plots (Figure 1,2,3,4), data is not distributed normally. Therefore, multiple linear regression cannot be conducted because of the violation of the normality. Hence, generalized linear model was conducted. Response variable (progress-score) represents a discrete and count data. Therefore, Poisson regression was conducted. Since the minimum residual (-2.0010) and the maximum residual (2.4403) lies within (-3,3), outlier and leverage point problems are not observed. To check whether there is overdispersion problem or not, residual deviance (185.6) was divided by degrees of freedom (263). Result of this calculation is smaller than one ( $<1$ ), so there is no overdispersion problem. As a result, there is no obstacle to conduct Poisson regression.

#### **4. Results**

The hypothesis test was conducted with 0.95 significance level to check whether means of the efficiency of apps and efficiency of courses differs from each other or not. Alternative hypothesis was true difference in means between group App and group Course is not equal to 0. As a result, p-value of the hypothesis testing was resulted as 0.1259. 95% confidence interval:  $-0.39207392 < \mu_1 - \mu_2 < 0.04851564$ . Hence, null hypothesis cannot be rejected. There is no significant difference between  $\mu_1$  and  $\mu_2$ .

Poisson regression was conducted in RStudio by using GLM (generalized linear model) function with Poisson family to observe the relationship between learning progress and factors such as total learning time, weekly learning time, and learning a new alphabet.

Poisson regression model:

$$\begin{aligned} \log(\text{progress score}) = & -0.9184 - 0.071(\text{alphabet}_{yes}) + 0.7836(\text{total time}_1) + \\ & 1.2639(\text{total time}_2) + 1.2(\text{total time}_3) + 1.2227(\text{total time}_4) + 0.9767(\text{total time}_5) + \\ & 1.3854(\text{total time}_6) + 0.2236(\text{weekly time}_1) + 0.2083(\text{weekly time}_2) + \\ & 0.4421(\text{weekly time}_3) + 0.5862(\text{weekly time}_4) + 0.0035(\text{method}_{course}) \end{aligned}$$

- $\text{alphabet}_{yes}$  is a dummy variable,  $\text{alphabet}_{no}$  is taken as a reference.
- Total time has 6 dummy variables, 0-3 month is taken as a reference:
  - $\text{total time}_1$ : 4-7 months
  - $\text{total time}_2$ : 8-11 months
  - $\text{total time}_3$ : 12-15 months
  - $\text{total time}_4$ : 16-19 months
  - $\text{total time}_5$ : 20-23 months
  - $\text{total time}_6$ : 2+ years
- Weekly time has 4 dummy variables, 0-1 hour is taken as a reference:
  - $\text{weekly time}_1$ : 2-3 hours
  - $\text{weekly time}_2$ : 4-5 hours
  - $\text{weekly time}_3$ : 6-7 hours
  - $\text{weekly time}_4$ : 8+ hours
- $\text{method}_{course}$  is a dummy variable,  $\text{method}_{app}$  is taken as a reference.

Following table shows the p-values of coefficients:

Coefficients	p-value
<i>Intercept</i>	5.69e-07



<b><i>alphabet<sub>yes</sub></i></b>	0.597738
<b><i>total time<sub>1</sub></i></b>	0.000106
<b><i>total time<sub>2</sub></i></b>	6.66e-10
<b><i>total time<sub>3</sub></i></b>	6.02e-08
<b><i>total time<sub>4</sub></i></b>	0.005425
<b><i>total time<sub>5</sub></i></b>	0.026128
<b><i>total time<sub>6</sub></i></b>	3.48e-12
<b><i>weekly time<sub>1</sub></i></b>	0.107432
<b><i>weekly time<sub>2</sub></i></b>	0.218205
<b><i>weekly time<sub>3</sub></i></b>	0.131605
<b><i>weekly time<sub>4</sub></i></b>	0.140822
<b><i>method<sub>course</sub></i></b>	0.977966

According to table, intercept, coefficient of *total time<sub>1</sub>*, *total time<sub>2</sub>*, *total time<sub>3</sub>*, *total time<sub>4</sub>*, *total time<sub>5</sub>*, and *total time<sub>6</sub>* are significant with 0.05 significance level.

## 5. Conclusion

According to the result of hypothesis testing, p-value is 0.1259. Then, null hypothesis cannot be rejected. This means that average efficiency of course and online applications are not different. According to data collected from METU students, there is no great difference between course and online applications in terms of efficiency.

The result of Poisson regression shows the followings:

- Average progress score for new alphabet learners is 0.9315 times higher than not new alphabet learners.
- The average progress score for participants with a total learning time of 4-7 months is 2.1894 times higher than participants with a total learning time of 0-3 months.

- The average progress score for participants with a total learning time of 8-11 months is 3.5391 times higher than participants with a total learning time of 0-3 months.
- The average progress score for participants with a total learning time of 12-15 months is 3.3204 times higher than participants with a total learning time of 0-3 months.
- The average progress score for participants with a total learning time of 16-19 months is 3.3963 times higher than participants with a total learning time of 0-3 months.
- The average progress score for participants with a total learning time of 20-23 months is 2.6557 times higher than participants with a total learning time of 0-3 months.
- The average progress score for participants with a total learning time of 2+ years is 3.9963 times higher than participants with a total learning time of 0-3 months.
- The average progress score for participants with a weekly learning time of 2-3 hours is 1.2506 times higher than participants with a total learning time of 0-1 hours.
- The average progress score for participants with a weekly learning time of 4-5 hours is 1.2316 times higher than participants with a total learning time of 0-1 hours.
- The average progress score for participants with a weekly learning time of 6-7 hours is 1.5560 times higher than participants with a total learning time of 0-1 hours.
- The average progress score for participants with a weekly learning time of 8+ hours is 1.7972 times higher than participants with a total learning time of 0-1 hours.
- The average progress score for course attendants is 1.0035 times higher than online application users.

When looking at the p-values, the average progress score of all of the total time categories significantly differs from the reference value (0-3 months). The average progress score of weekly time categories does not significantly differ from the reference value (0-1 hour). The average progress score of new alphabet learners does not significantly differ from not new

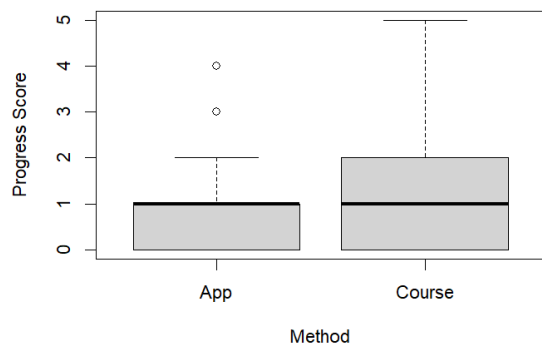
alphabet learners. The average progress score of course attendants does not significantly differ from the app users.

In conclusion, according to hypothesis testing and Poisson regression, there is not a great difference between online applications and courses with respect to effectiveness and improvement.

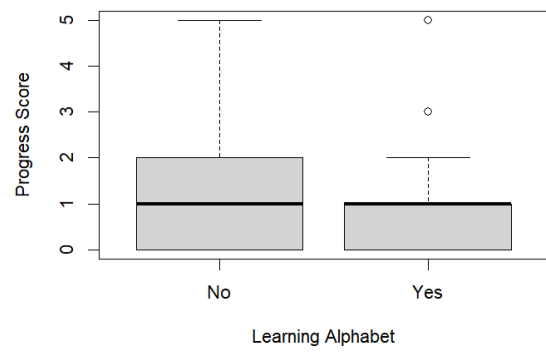
## **REFERENCES**

- Choueiry, G. (n.d.). *Interpret Poisson Regression Coefficients*. QUANTIFYING HEALTH.<https://quantifyinghealth.com/interpret-poisson-regression-coefficients/>
- Jabeen, H. (February 27, 2019). *Tutorial: Poisson Regression in R*. DATAQUEST.  
<https://www.dataquest.io/blog/tutorial-poisson-regression-in-r/>
- von Ahn, L. (April, 2023), *How To Make Learning As Addictive As Social Media*. TEDX.[https://www.ted.com/talks/luis\\_von\\_ahn\\_how\\_to\\_make\\_learning\\_as\\_a\\_ddictive\\_as\\_social\\_media](https://www.ted.com/talks/luis_von_ahn_how_to_make_learning_as_a_ddictive_as_social_media)

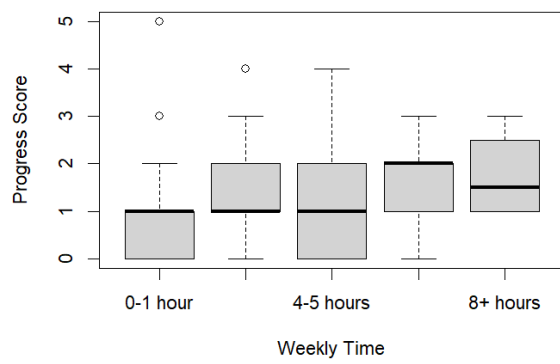
## Appendices



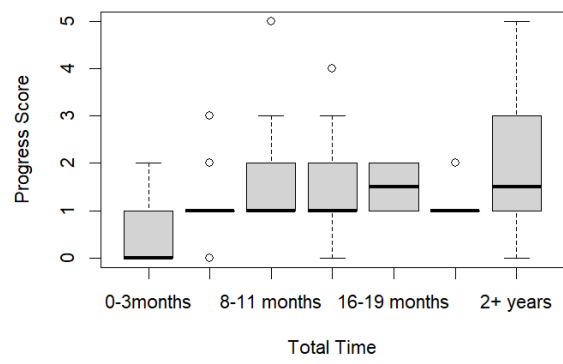
**Figure 1**



**Figure 2**



**Figure 3**



**Figure 4**

**Figure 5: (Survey Questions)**

## EFFICIENCY OF ONLINE APPLICATIONS AND COURSES FOR LANGUAGE LEARNING AMONG METU STUDENTS

*This survey was conducted for STAT365 lecture project to analyze the efficiency of online applications and courses for language learning among METU students. The collected information will be used only for academic purposes. Your data will not be shared with any third parties and it will kept anonymous.*

İlerleme durumunu kaydetmek için [Google'da oturum açın](#) [Daha fazla bilgi](#)

**\* Zorunlu soruyu belirtir**

Which year you were born? \*

*Hangi yılda doğdunuz?*

Yanıtınız

What is your gender? \*

*Cinsiyetiniz nedir?*

☐ Female

☐ Male

☐ Prefer not to say

☐ Diğer:

What is your education level? \*

*Öğrenim durumunuz nedir?*

☐ Prep-school

☐ year 1

☐ year 2

☐ year 3

☐ year 4

☐ Graduate(MSc, PhD, Post-doc,...)

☐ Diğer:

What is your department? \*

*Bölümünüz nedir?*

Yanıtınız

Which language do you study at main level? (except English) \*

*(İngilizce haricinde öğrendiniz dil nedir?)*

Yanıtınız

How do you learn this language? \*

*(Bu dili nasıl öğreniyorsunuz?)*

- ☐ via Apps (i.e. Duolingo, Busuu, Cake, Memrise...)
- ☐ Courses (online/face to face) (i.e. MLD (Department of Modern Languages) , Goethe Inst., TÖMER,...)

#### Online applications

If you chose app, which one do you prefer? \*

*(Eğer uygulama kullanıyorsanız, hangisini tercih edersiniz?)*

Yanıtınız

#### Language courses

If you chose course, which one do you prefer?

*(If you attend to MLD (Department of Modern Languages) course, please state as "MLD".)*

*Eğer kurs seçtiyseniz, hangisini kursu tercih ediyorsunuz?*

*(Eğer MLD derslerine katılıyorsanız lütfen "MLD" yazınız.)*

Yanıtınız

*Bu dili öğrenmeye başladığınızdaki seviyeniz nedir?*

- ☐ Beginner
- ☐ Elementary
- ☐ Pre-intermediate
- ☐ Intermediate
- ☐ Upper-intermediate
- ☐ Advanced
- ☐ Proficient (Fluent)

*Bu dilde şu anki seviyeniz nedir?*

- ☐ Beginner
- ☐ Elementary
- ☐ Pre-intermediate
- ☐ Intermediate
- ☐ Upper-intermediate
- ☐ Advanced
- ☐ Proficient (Fluent)

*Bu dili ne zamandır öğreniyorsunuz?*

[illegible]



How much time do you spend for learning this language weekly? \*

*Bu dile haftalık ne kadar süre harcıyorsunuz?*

0-1 hour

2-3 hours

4-5 hours

6-7 hours

8+ hours

Time

☐☐☐☐☐

Please rate the efficiency of the application you are using or the course you are attending. \*

*Lütfen kullandığınız uygulamanın veya katıldığınız kursun verimliliğini derecelendiriniz.*

1

2

3

4

5

highly ineffective

☐☐☐☐☐

highly effective

Which skill do you expect to improve by using the application or attending the course? \*

*Kullandığınız uygulama veya katıldığınız kurs ile hangi yeteneğinizi geliştirmeyi amaçlıyorsunuz?*

☐ Speaking

☐ Listening

☐ Writing

☐ Reading

☐ Vocabulary

☐ All of the above skills

Is it necessary to learn a new alphabet for the language that you are learning? (i.e. \* Kanji, Hiragana, Cyrillic, Chinese Hanzi,...)

*Bu dil için yeni bir alfabe öğrenmeniz gerekiyor mu? (örneğin; Kanji, Hiragana, Cyrillic, Chinese Hanzi,...)*

☐ Yes

☐ No

☐ Don't know