

English Language Education for Engineering Majors at a University in Japan: Predictive Factors and Reflections on Screening for Effective and Riveting In-Class Activities

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Abstract

The objective of this study is to illuminate key predictive variables as well as preferences and wishes of Japanese undergraduate students majoring in engineering, in terms of English language education. By means of a questionnaire, relevant data were collected from 120 students at the University of Hyogo in January 2016. To reckon statistical predictors, *lambda* for nominal variables and *gamma* for ranked variables were calculated. The results elucidated the following: (1) the degrees of liking English in junior and senior high school days are each predictive of how much the respondent likes English today; (2) the numbers of weekly hours spent studying English at home in junior and senior high school days are predictive of the weekly hours spent studying English at home today; and (3) the degree of how much the respondent likes English today is predictive of his/her score on the proficiency quiz. The survey also highlighted that speaking was the most liked in-class activity among the students, while studying grammar rules was the least favored. With regard to selecting in-class activities, a number of factors such as the students' age, gender, knowledge level, proficiency (both in native and English languages), interest, personality, in-class "chemistry," social capital, motivation level, and the field of study should be taken into consideration, in addition to statistical as well as intuitive factors.

1. Introduction

Arts, humanities, natural sciences, mathematics, and social sciences constitute a large part of liberal arts education for undergraduate students in many contemporary Japanese universities. As the origin of these branches of learning can be traced back to a single discipline—i.e., philosophy—as attested to by the works of great Greek philosophers' like Plato's and Aristotle's, these apparently distinct categories of learning share similarities with one another (Bambrough, 1965). Regardless of one's field, as one goes through life as an individual, one is likely to benefit from a solid background in liberal arts education in addition to his/her major field of study; i.e. one enlightened with refined liberal arts education is equipped with not only eclectic

perspectives but also a freed mind to deal with everyday events and problems one inevitably encounters in life, albeit the application of the fruits of liberal arts education may remain subconscious to the enlightened.

In particular, it is probable that students of science can benefit profoundly from fathoming the areas encompassed by liberal arts education. Take English language education in Japan, for instance. As we live in today's globalizing world where English is one of the internationally accepted and practiced languages and is used by an approximate 20% of the entire population of the world, what would be the practical and efficient language for a Japanese graduate student majoring in, e.g., electrical engineering to communicate with his/her counterpart(s) from Australia, China, Germany, South Korea, or the United Kingdom? Before answering the question, let us keep in mind that, after all, liberal arts education should emancipate the mind of the learner, if it serves its originally intended function. In the given hypothetical scenario, the English language would probably be the best choice that could liberate the graduate student from his/her otherwise would-be pent-up frustrations resultant of not being able to get the message(s) across to his/her international comrade(s). Perhaps more than ever before, the globalizing scientific community calls for refined liberal arts education in general and English language education aiming at not only generic but also specific purposes in particular.

Likewise, just as much as the students of science can benefit from having a solid liberal arts background upon which to build their faculties and knowledge of their respective fields, educators of disciplines that are traditionally considered either "scientific" or "non-scientific" can gain insights from comprehending their work in a scientific or quantitative manner—that is, in addition to an intuitive or impressionistic grasp of the state of affairs. In most work-related situations, evidence-based inferences would probably be more useful and practical than any guess work to any educator. This study is the authors' second step—following the poster presentation for the Japan Association of International Liberal Arts (JAILA) at the Tokyo University of Science in March 2016—to discerning what matters to and for the students of science in the context of English language education in a quantitative fashion (Uchiyama et al., 2016). Specifically, the objectives of this research are (1) to illuminate—in terms of English language education for engineering majors at a university in Japan—key predictive variables, and (2) to reflect on the students' preferences as well as a selection process for effective and intriguing in-class activities.

2. Method

This study is based on a survey research making use of a questionnaire, as well as five English composition tasks for assessing proficiency, particularly in communicable sentence construction. The items in the questionnaire can be divided into the areas of demographic information, information on past study habits and opinions of English language and of its education, current status and viewpoints of English learning, and wishes for the future in terms of

English language and its pedagogy. For statistical analyses, the vast amount of results has been categorized into one of the following three taxa: (1) the past associated with the past, (2) the past associated with the present, and (3) the present associated with the present. For instance, if the number of weekly hours spent studying English at home during senior high school days (which is a past event) is associated with how much the respondent likes English today, the pair would be classified into the second pattern of the past associated with the present.

In addition to the questionnaire, a set of English composition tasks or a quiz is provided at the end of the questionnaire. The quiz is used as a provisional assessment tool to evaluate the respondent's current level of proficiency in formulating English sentences in a communicable or at least an understandable way. In the quiz, the respondent is provided with five Japanese sentences which make use of, for example, subjunctive mood, past perfect, infinitives, and proverbial expressions. For each sentence, the respondent is asked to write an English sentence that matches the given Japanese version. To make the conditions uniform and consistent, only ten minutes are allotted for the composition tasks; furthermore, to raise the extent of standardization, grading on a 0-to-10 scale is carried out thoroughly by one researcher. The results in conjunction with those of the questionnaire are statistically analyzed for associations or tendencies.

2.1 Participants

The survey was carried out at the University of Hyogo, Himeji Campus for Engineering, Japan, in January of the year 2016. The University of Hyogo, as it is known today, was established in 2004 when its former entities comprised of three prefecture-operated colleges—namely, (1) Kobe University of Commerce (2) Himeji Institute of Technology, and (3) College of Nursing Art and Science Hyogo—merged to constitute a public university run by Hyogo Prefecture—located in the Midwestern part of Honshu or the main island of the Japanese archipelago. The university possesses seven campuses located in various sites of the prefecture. As of 2016, the university has six undergraduate faculties and 12 graduate departments. In addition to the engineering majors, students majoring in Human Science and Environment, as well as those majoring in Sciences, take lower division courses on the Himeji Engineering campus.

For the survey, the respondents were selected based on convenience sampling: The engineering students taking the authors' English classes on Writing 1, Reading and Discussion 1, Listening and Speaking 2, and Technical English classes participated in the study if they agreed to the condition that the data be utilized in research for improving English language pedagogy. In total, 120 students responded to the survey, while a few submitted partially incomplete responses.

With the use of the collected data, 515 bivariate combinations have been tested for meaningful statistical associations, utilizing *lambda* for any combination involving one or two nominal variables, to reckon the strength of a given association. The formula is as follows:

$$A = (E1-E2) / E1$$

On the other hand, for testing combinations of two ranked variables, *gamma* has been tallied to evaluate the strength of the relationship. The formula for gamma is shown below:

$$\Gamma = (Ns-Nd) / (Ns + Nd)$$

Both lambda and gamma yield outcomes in the range of 0 to 1 that expresses the predictive value of one variable over another in an asymmetrical manner. The numeric value of 0 indicates the weakest predictive value, and that of 1 signifies the firmest. For more detailed explanations on lambda and gamma, refer to Babbie and Halley (Babbie et al., 1998).

3. Results

■ **Table 1: Descriptive statistics of the respondents (N=120)**

Demographic Variable	Valid Number	Valid Percentage
Gender		
Male	97	82.9
Female	20	17.1
Grade		
First-year (or Freshman)	59	51.3
Sophomore	44	38.3
Junior	11	9.6
Senior	1	0.9

Table 1 shown above provides descriptive statistics of the respondents. As mentioned previously, the results of statistical analyses in this study are categorized into three types. The first kind is called, the past associated with the past. Succinctly put, this type refers to the cases wherein both independent and dependent variables are relevant to the past. Table 2 in the following displays the outcomes of this kind, involving nominal variables.

■ **Table 2: The past associated with the past involving one or more nominal variables**

Independent Variable	Dependent Variable	Lambda	Value of Significance
The most boring activity experienced in English class	Experience of a visit abroad	0.314	0.007

Likewise, Table 3—shown below—lists notable results of the past associated with the past, but this time between ranked variables. For this set of variables, gamma was used to reckon the magnitude of the relationship within each pair of the variables.

■ **Table 3: The past associated with the past involving two ranked variables**

Independent Variable	Dependent Variable	Gamma	Value of Significance
Rank of English on the list of favorite subject during junior high school years	Rank of English on the list of favorite subject during senior high school years	0.685	0.000
Weekly hours spent studying English at home during junior high school days	Weekly hours spent studying English at home during senior high school days	0.618	0.000

The second category of the results is termed the past associated with the present. This class of association involves combinations of independent variables that are related to the past and dependent variables pertinent to the present: in short, this category is about past events being predictive of today's phenomena. See Table 4 for the outcomes.

■ **Table 4: The past associated with the present with two ranked variables**

Independent Variable	Dependent Variable	Gamma	Value of Significance
Rank of English on the list of favorite subject in senior high school years	Rank of English on the list of favorite subject today	0.638	0.000
Rank of English on the list of favorite subject in junior high school years	Rank of English on the list of favorite subject today	0.638	0.000
Weekly hours spent studying English at home during junior high school days	Weekly hours spent studying English today	0.412	0.000
Weekly hours spent studying English at home during senior high days	Weekly hours spent studying English today	0.365	0.000
Number of times spoken with foreigners	Score of English proficiency quiz	0.333	0.000

The last of the three categories of the outcomes is entitled the present associated with the present, which refers to bivariate associations within combinations of variables in which both

variables pertain to the present. See Table 5 for the results. The first pair on the list—the association between “Degree of liking English today” and “Score of English proficiency quiz”—is based on the question, “What numeric value—in the range of 0 to 10—would you assign to quantify how much you like English language, given that 0 is the lowest and 10 the highest preference?” and the provisional assessment quiz provided at the end of the questionnaire. Both are relevant to the present with respect to the time at which the survey was carried out.

■ **Table 5: The present associated with the present with ranked variables**

Independent Variable	Dependent Variable	Gamma	Value of Significance
Degree of liking English today	Score of English proficiency quiz	0.354	0.000
Rank of English on the list of favorite subject today	Score of English proficiency quiz	-0.302	0.000

4. Discussions

First, let us discuss the results displayed in Table 3. The listed outcomes are between ranked variables classified as the past associated with the past. Accordingly, the results in Table 3 are of the gamma, which is suitable for ranked variables. The implications of the results in the table seem unequivocal: Simply put, one’s study habits and the degree of a penchant for the English language tend to persist throughout junior and senior high school years. In other words, the results turned out to demonstrate that those who listed English high on their list of favorite subjects during their junior high school years have a high predictive value of having done likewise for their senior high school years as well. Briefly put, the former variable is predictive of the latter.

Moreover, those respondents who spent much time studying English at home during their junior high school days have a high predictive value of having done so also for the subsequent senior high school days; i.e., studiousness tends to persist throughout junior and senior high school days. These results seem to support the notion that it is beneficial for one to like (and learn) English as early as possible, and establish a regular study habit in early years of one’s education, if one wishes to be proficient in the English language in the long run. These results are reminiscent of the proverb, “Old habits die hard” in a generic sense, though there are certainly exceptions to the tendency (Uchiyama et al., 2016).

This tendency, however, becomes even clearer as one takes a closer look at the outcomes in Table 4. The table lists the combinations of ranked variables between the past and the present. Of the five combinations listed, two are those related to the rank of English on the list of favorite subject in the past influencing how much the respondent is fond of English today. Simply put,

the results could be interpreted as: The higher—i.e., the closer to the top—the rank of English on the list of favorite subject in the past was, the more the respondent tends to like English today. Of the three remaining combinations, two, on the other hand, are related to the past study habits—or “hours” spent studying English to be more precise—being predictive of the amount of time spent studying English today. In other words, the relationships can concisely be paraphrased as, “The more one studied English in the past, the more he/she tends to study it today.” It is likely that neither of these two tendencies would come as a surprise to any observant instructor of English language who teaches Japanese university students, as such inclinations seem to underlie the level of comprehension, and in-class attitude of the majority of the students. In a grander scheme, Schneider and Shoenberg, in their study, cogently demonstrate how habits are detrimental to campus reform (Schneider et al., 1999). However, in the classroom setting—as is the case in the present study—if the students already possess constructive habits that are instrumental to the acquisition of new knowledge, there is no need for a reform indeed. If a few of the students in the class are in need of a habit-reform, the instructor could at least try to guide and assist the reform in an eclectic and flexible manner.

Now we shall turn to the last combination of the variables in this category. The remaining one combination of the ranked variables for the category of the past being predictive of the present is that between the number of times spoken with foreigners and the score of the assessment quiz. The relationship between the two variables is seldom or never astonishing in that it is sensible to construe that a person who has had intensive as well as extensive experience speaking with foreigners in English would likely score higher on an English proficiency quiz than another who rarely has had such an experience. Another possible interpretation is that one who has the will or is motivated enough to seek out opportunities to speak with foreigners in English would likely perform better on the assessment quiz than another who is passive. Regardless of which interpretation one adopts or rejects, the relationship between the two variables seems nearly commonsensical, but must be taken into account and highlighted herein because of its being a piece of quantitative evidence for the relationship, in lieu of a whimsical impression or an opinion.

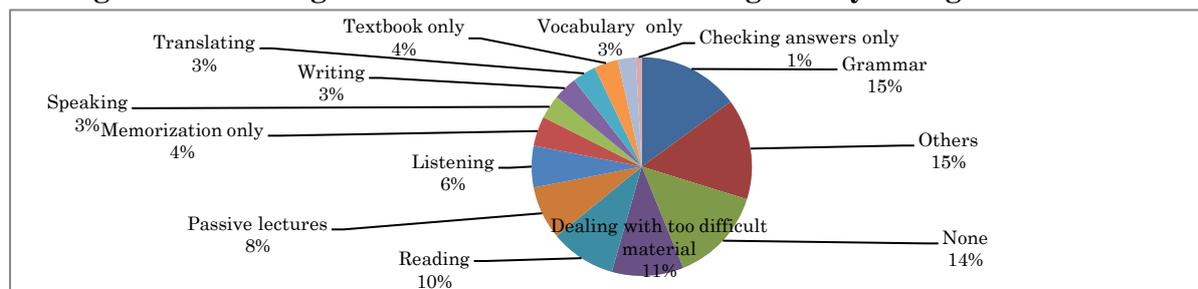
Proceeding to the next and the last table, Table 5 displays the results between ranked variables wherein the present condition is predictive of another current event; i.e., it is “Now associated with now.” The two pairs of variables on the table are mutually supportive of each other in terms of the message they convey: That is, simply put, the extent to which the respondent likes English today can be used as a predictor for the score on the assessment quiz. The first set deals precisely with the degree of liking English, while the second pair is of the rank of English language on the list of the respondent’s favorite subject. Both of these associations can be interpreted as representing the underlying tendency that the respondent tends to do well on the assessment quiz to the extent to which he/she likes the English language.

The major outcomes that have been detailed so far of the statistical analyses in this study can be summarized as follows: (1) Not only the level of liking English in junior high school is

predictive of that in senior high school, but also each of the preceding is predictive of the degree of liking English today; (2) the number of weekly hours spent studying English at home in junior high school days, as well as that in senior high school days, is predictive of the number of hours spent studying English at home today; (3) the degree of liking English today is predictive of the score on the proficiency quiz.

One of the possible implications of these findings is that it is beneficial, from the academic standpoint, to cultivate not only a preference for the English language, but also a consistent study habit for the language acquisition at a young age—no later than junior high school days, if possible. Notwithstanding the preceding statement, the preference for the discipline and the regular study habit usually go hand in hand. Thereby, one possible role of the instructor is to assist the students by making efforts to provide opportunities for the students to use and hopefully enjoy the language, so that they will like it better and be more familiar with it or—even better—more proficient in it than they are now. Based on this study, if the students like the language, they may have a good chance of maintaining the fondness for the language as well as keeping its equivalent levels of knowledge and skills in the language. In consequence, the next question to ask may be, “What are in-class activities that enable the students to like English?”

■ **Figure 1: Percentage of answers to “The most boring activity in English class”**



Nevertheless, before delving into what the students enjoy in the classroom, perhaps it is sensible to take a look at what they find humdrum or boring, so as not to overdo these possibly sleep-inducing or perhaps daunting activities. See Figure 1 (Uchiyama et al., 2016). Returning to Table 2, it is worth pointing out again that the most boring activity in English class undergone by the respondents is modestly predictive of the presence or absence of experience abroad. Let us scrutinize the responses further. In particular, the respondents who have specified studying grammar rules as the most boring activity in English language education offer an intriguing example. Of the total of 120 respondents who participated in the study, 15% specified that studying grammar rules was the most boring activity in their experience of English language education to date. Of this 15% of the respondents, an equivalent to 63% had been abroad, while the rest of 37% had never been overseas. In other words, more respondents who had been abroad found that studying grammar rules was the most boring activity in their English language

education than those who had not. The possible implication is that, in general, the students who were repugnant to studying grammar rules and preferred practical—rather than theoretical or grammatical—aspects of the language had a higher probability of going abroad. To these potentially practically-minded people, it may be that excessive emphasis on grammar rules or pontifications about what seem like microscopic matters simply appear monotonous and nearly hypnagogic or sleep-inducing.

The ideal classroom scenario of any English language instructor may be that all students, without any exception, are actively engaged in assigned activities—of course, including listening attentively to the instructor—to acquire the language, while willingly complying with the directions provided by the instructor. To get as close as possible to this hypothetically normative situation, choosing an activity that best suits the students is crucial. The importance of selecting not only interesting but also effective activities in classroom settings has been addressed by many researchers including Fukuda and her colleagues (Fukuda et al., 2014). Without a doubt, any experienced instructor's list of activities from which to implement in-class activities may be fairly extensive. From such a lengthy list, what criteria should the instructor employ to decide which activities to execute in class? The answers may not be as simple as they may seem.

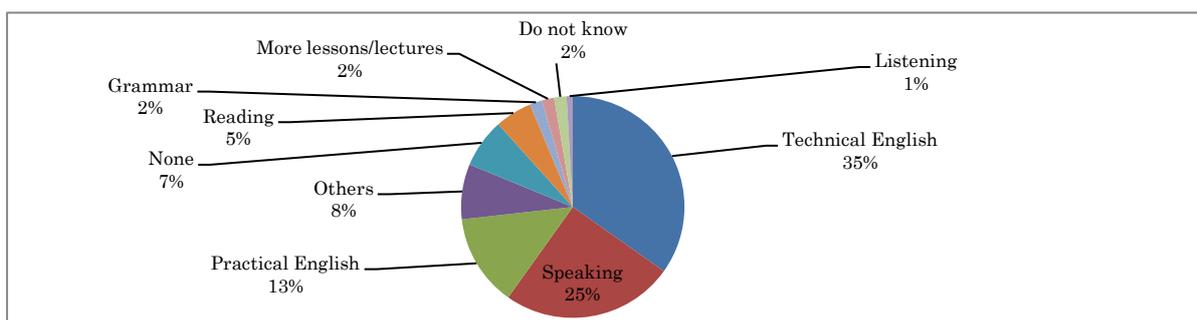
In effect, some studies on classroom activities have come up with incongruent outcomes, which seem to complicate the process of activity selection. For instance, Sakurai found in her study on university-level reading class in Japan that cooperative learning imparted much satisfaction to the students by providing a sense of security, opportunities for communication, mutual help as well as support, and a sense of responsibility (Sakurai, 2015). In contrast, Jafari and Ketabi found that Japanese students—in comparison with Iranian, Singaporean, Hong Kong, and the mainland Chinese students—expressed “more conservative preferences” that are non-communicative and less cooperative in English language instructions (Jafari et al., 2014).

Given such potentials for unpredictability and a variety of preferences, sensible screening for activities may require that the experienced instructor employ intuitive, empirical, and perceptive grasp of the needs of the given students. In addition, Folse and Educational Testing Service (ETS) have enumerated the following as some of the important factors to take into consideration: namely, the student's age, the level of proficiency in English, that in the student's native language, personality, and interest (Folse, 2003; ETS, 2009). Evidently, the interest or the wish of the student is absolutely another significant criterion for the instructor to heed. If such information is available in valid and reliable statistical data, there is no reason not to utilize them or refer to them at least. Another factor to consider is the level of motivation among the students, which can vary both within—longitudinally—and among individuals. Furthermore, the “chemistry” among the students should also be taken into consideration particularly for some activities that may involve pair or group work. The potential impact of social capital on the matters of “chemistry” among the university students in the classrooms for English language education is definitely another significant domain that needs to be scrutinized in future studies.

One example of studies on the role of social capital in the classroom setting is one by Van Rossem et al.; and they found that social capital is beneficial both at individual and class levels, even though their study is based on elementary school students in the Netherlands (Van Rossem et al., 2013). It is indispensable to examine within-class “chemistry” or interactive dynamics of the students and their impacts on academic achievements in the university level classrooms in Japan as well.

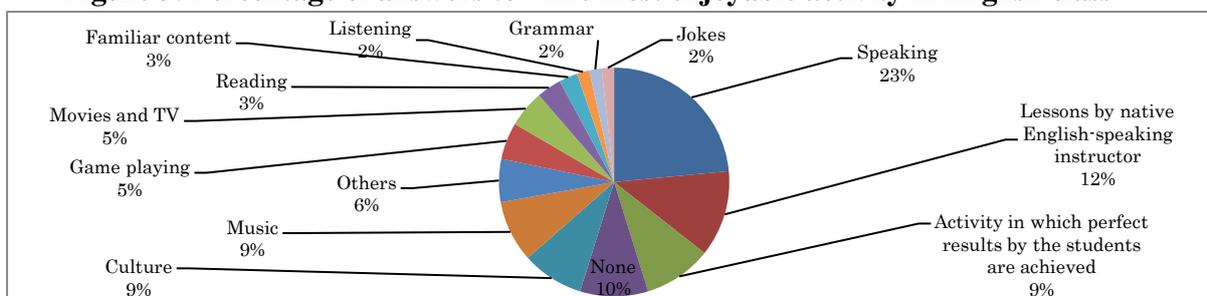
Another key factor that requires consideration is the students’ expectations as to what they wish or want in English language education at the University. This aspect was examined in this study too. Figure 2 illustrates the results. It is noteworthy that “Technical English,” combined with “Practical English” and “Speaking” constitute 73% of all respondents.

■ **Figure 2: The Respondents' Wishes in English Education at the University**



Now let us turn to the most enjoyable activity experienced by the respondents. See below for Figure 3 (Uchiyama et al., 2016). Of the 120 respondents, an approximate 23% selected “Speaking” as the most enjoyable activity they have had in English classes. Of these respondents, 62% had been abroad, while 38% had had no experience overseas. In other words, “Speaking” was favored more by the respondents who had been abroad than those who had not.

■ **Figure 3: Percentage of answers to “The most enjoyable activity in English class”**



As far as the authors’ classes are concerned, “Speaking” in the context of this study refers to an activity that was routinely practiced wherein topics related to everyday or current events

were assigned to the students; subsequently, they were asked to talk about or discuss the topics with their partners who were sitting at the neighboring desks, and then with the instructor, who would often supplement the discourse with some additional questions to embellish the interactions. In view of encouraging voluntary participations of the students, a few extra points were rewarded as part of the weekly review quiz on vocabulary (usually worth 10 points each) to the students who volunteered to discuss before the entire class. The bonus points surely served as an incentive to some students. Though a few of the students were too nervous to speak or discuss before the class, it is the observation of the instructors that many of the students who participated in the dialogue exchanges were pleased with the experience not only when they became the speakers, but also when they listened to their classmates exchanging amicable words. In short, the activity seemed to have enhanced the level of gratification for many of the students.

Cultivating the motivation to communicate with fellow students and providing opportunities to experience the English language are primary objectives of the activity. Perhaps not many prudent thinkers would argue against the idea that the more frequently an English learner speaks in English with a person—particularly one from an English-speaking country—the more the learner’s English communication skills in the language will develop over time. Indeed, the eagerness to communicate (or lack thereof) appears to play a significant role in one’s progress (or its absence) in the process of language acquisition. In effect, Morozova identifies the opposing force of eagerness—that is, reluctance to communicate—as a crucial factor hindering the overcoming of the language barrier in English (Morozova, 2013). Such a reluctant tendency has sometimes been observed in some classroom settings in Japan as well. If the hesitance to communicate is detected in the classroom, it is critical for the instructor, when appropriate, to expound—without being too didactic—the potential benefits of surmounting the passivity to the students, including the advantages of being able to use the English language with specific examples from the instructor’s life experiences as well as how overcoming the passivity is one of the key breakthroughs in the process of gaining fluency in the language. After all, the mastery of a language, though the existence of such in the strict sense of the term is highly debatable, inevitably takes many mistakes and subsequent learnings from them on the part of the learner.

In summary, this study’s results can be abridged as follows: statistically, the levels of the penchant for the English language in junior and senior high school days are predictive of the degree of preference for the language today; moreover, the numbers of weekly hours spent studying English at home during junior and senior high school days are also predictive of that for the university days; and how much the respondent likes English today is a predictive factor for the score on the proficiency assessment quiz. When selecting in-class activities, catching a statistical glimpse into the likes and dislikes of the students is an additional asset to the sensible considerations of the following factors: age, gender, current knowledge, levels of proficiency in English and native tongue, personality, motivation level, in-class “chemistry” as well as social capital, the major field of study, and, finally, the interest of the students.

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