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| RESEARCH ARTICLE

Natural Sciences or Humanities? A Case Study of Japanese University Students' Awareness in Second Language Learning

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| ABSTRACT
This study investigates how university students implicitly position second language learning in relation to other subjects, based on their experiences within the pre-college curriculum in Japan. Factor analysis of preference data collected from 793 university students across 20 subjects, including English (as a second language), revealed no overarching factors that connected English with other disciplines in models with fewer factors. However, when the number of factors was increased to seven, English demonstrated a moderate loading (0.5), but this factor also exhibited an association with P.E. Rather than forming a distinct thematic category, it appeared to group of "miscellaneous" subjects. Alternatively, it might represent the "subjects involving intentional activity," depending on factor loadings. The supplementary regression analysis suggests that preferences for subjects other than English and their English proficiency are not significantly related. Nevertheless, as only five factors accounted for statistically significant variance in the observed data, the results suggest that rigidly categorizing second language learning within a specific academic domain may have limited interpretive value.

| KEYWORDS

English language learning, humanities and natural sciences divide, factor analysis, multidisciplinary education, educational curriculum, subject preferences.

| ARTICLE INFORMATION

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1. Introduction

There exists a vast body of research examining the traits of learners who excel in English as a second language. Among these traits, one of the most prominent distinctions, widely acknowledged not only by scholars but also by the broader public, is whether the learner belongs to the humanities or the sciences. Japan, for instance, is notable as a country where the division between humanities and science curricula is distinctly delineated.

Students' perception of their English proficiency will be largely shaped by their performance on assessments within the Japanese educational system. Consequently, reading comprehension, particularly in relation to grammatical accuracy, tends to be the primary determinant, with listening skills playing a secondary role and written expression typically confined to brief, limited responses.

It is believed not only by learners but also by English teachers that science students are not proficient in English (Katayama, 2022). However, when looking at the research results from various universities, there does not seem to be a consistent trend regarding whether students in the humanities or sciences are better at English (e.g, Hashimoto, et al., 2002; Ito, et al, 2004; Nakamura, 2019). However, there are also survey results indicating that a higher proportion of students in the humanities track consider themselves proficient in English compared to those in the science track (Hananoki, Isozuka & Hatashi, 2017).

Not limited to Japan, Kasim, Muslem, and Mustafa (2019) explored differences in English proficiency between social science and natural science students at four public universities in Indonesia. Utilizing TOEFL paper-based tests, they compared student performance across three key areas: listening, structure and written expression, and reading comprehension. The result shows that natural science students excelled in lecture-based listening tasks, which the authors attributed to their frequent exposure to academic vocabulary prevalent in scientific discourse. In contrast, social science students performed better in main idea comprehension during reading tasks, likely due to their greater familiarity with general and text-based content.

Thus, the longstanding "humanities versus natural sciences" dichotomy persists, raising questions about its veracity. More specifically, where does English as a subject truly belong? Is it best situated within the humanities, the sciences, or does it constitute a distinct academic domain altogether? To address this inquiry, the present study analyzes university students' subject preferences and explores the academic conceptualization of English within the broader educational framework.

2. Literature review

This section examines the relationship between students' academic specializations, particularly the humanities and sciences, and their language learning and usage, through a review of relevant literature.

In Japan, from an early stage in life—particularly at the university entrance examination level—students are effectively stratified into natural sciences and humanities (Oki, 2019). This bifurcation is clearly reflected in the structure of entrance exams, where the subjects tested vary depending on the faculty. Although national universities require candidates to take subjects from both domains in the Common Test for University Admissions, the more rigorous written examinations impose subject-specific requirements. Moreover, even within the same subject, the level of difficulty and scoring weight differ between the two fields. Consequently, in preparation for these exams, high schools prioritize concentrated instruction in either set of subjects, further reinforcing this dichotomy. According to the Japanese Ministry of Education, Culture, Sports, Science and Technology [MEXT] (2009), this dichotomy is rooted in 1918, when the Second Higher School Act was enacted, dividing students into humanities and science tracks beginning in their second year of high school. This system has remained in place to the present day.

Furthermore, this educational framework appears to shape the perceptions of Japanese individuals themselves, fostering a range of preconceptions—some rooted in stereotypes—regarding both academic domains. These perceptions, in turn, exert a considerable influence on students' decisions when selecting their field of study. For instance, it is not uncommon for students to opt for the humanities, citing a perceived weakness in mathematics as a determining factor (Okamoto, 2020).

Regarding English education in Japan, since the mandatory inclusion of English education in elementary schools in 2010, it has been systematically integrated into the curriculum from the upper elementary grades through high school. In 2020, this initiative was further expanded to commence from the third grade.

While the Course of Study has officially emphasized the cultivation of practical communication skills since 2003, in practice, success in university entrance examinations has long been perceived as the primary determinant of social advancement. Consequently, English has been positioned not as a tool for communication but rather as a subject geared toward exam preparation. As a result, reading and writing skills have been prioritized, while the development of speaking and listening abilities has remained secondary. (Hosoki, 2011).

This system has had a profound impact on the practice of academic disciplines as well. Regarding differences in language use between the humanities and the sciences, Zarei and Mansoori (2011) revealed that the use of metadiscourse elements varies significantly between humanities and non-humanities disciplines. They found that humanities, particularly in applied linguistics, emphasize interactional resources to engage readers and guide their interpretation. In contrast, non-humanities fields, such as computer engineering, rely more heavily on interactive resources to ensure textual coherence and structural clarity. They also argue that humanities scholars tend to focus on engaging readers and constructing flexible arguments, whereas non-humanities writers emphasize structural organization and clarity. These findings highlight the importance of recognizing field-specific writing conventions and cultural influences when teaching academic writing or fostering cross-disciplinary communication. Thus, it appears that differences in fields and variations in language use do align with general perceptions.

This aligns with the notion that the interconnectedness of language acquisition and culture has been a longstanding subject of discussion, with calls for its integration into educational practices (Kuo & Lai, 2006; Pollio, 1996). From this perspective, the study of English language learning may well be situated within the realm of the humanities.

However, what exactly constitutes the differences in curricula? Kamens, Meyer, and Benavot (1996) examine the historical development and global patterns of secondary education curricula, highlighting the interplay of cultural, economic, and societal influences. They identify four key curriculum types that reflect the shifting priorities of education systems worldwide:

(1) Classical Curriculum: Dominant in 19th-century Europe, this model emphasized Latin, Greek, and philosophy, serving as the foundation for elite education. Its influence declined in the 20th century as mass education systems emerged.

(2) Mathematics and Science Curriculum: Driven by industrialization and technological advancement, this approach prioritized science, technology, engineering, and mathematics (STEM) subjects, particularly in regions like Asia and Africa, where economic growth and skilled labor were national imperatives.

(3) Arts and Humanities Curriculum: A modernized extension of the classical tradition, this model incorporates contemporary subjects such as modern languages, literature, and history, catering to a broader range of learners.

(4) Comprehensive Curriculum: Prominent in the United States and Eastern Europe, this framework integrates a diverse array of subjects, aiming to promote educational equality and provide a well-rounded education for all students.

The authors argue that these curriculum types reveal both global trends toward standardization and persistent regional variations shaped by historical and cultural contexts.

Among the four mentioned above, (1) refers to a past curriculum, while (4) is more comprehensive. Therefore, broadly speaking, the educational curriculum is divided into two main categories: science (2) and humanities (3). For these two curriculum patterns, Kazawa and Sando (2012) examined the structural distinctions between the humanities and natural sciences, elucidating their impact on educational approaches and proposing reforms for science education. In the humanities, the academic structure is inherently self-contained, allowing students to engage with subjects without substantial prerequisite knowledge. This flexibility permits diverse approaches to learning, enabling individuals, even those without formal academic training, to achieve meaningful outcomes. For example, local historians often produce significant contributions despite lacking rigorous scholarly instruction. In contrast, the natural sciences demand a hierarchical and cumulative learning process, where foundational knowledge must be systematically acquired before advancing to more specialized areas. This rigid structure imposes a strictly sequential progression.

From learners' perspective, Räisänen (2023) reveals through interviews that individuals in engineering often perceive their field as situated between the humanities and the natural sciences, reflecting a more nuanced understanding of disciplinary boundaries. Rather than adhering strictly to a dichotomous classification, these individuals conceptualize their expertise as existing along a continuum, where elements of both scientific rigor and humanistic inquiry intersect. This perspective underscores the fluid and interconnected nature of academic disciplines, challenging the rigidity of traditional categorizations while highlighting the integrative potential of diverse fields of knowledge.

To further explore how social science and humanities students perceive language within a global perspective, Takenaga and Yamada (2019) explored the differences in the perception of global competency (GC) acquisition between the humanities/social sciences and STEM fields, while identifying notable areas of overlap. Both groups exhibited comparable levels of confidence in their proficiency in non-native languages, particularly English, as universities in Japan provide language courses and programs equally across disciplines. Similarly, students in both fields demonstrated strong self-assessments regarding knowledge within their areas of expertise, though the nature and content of this knowledge differ significantly.

However, Takenaga and Yamada (2019) also argued that several key distinctions emerged. For instance, STEM students reported lower confidence in their ability to build friendships with individuals from different cultural backgrounds and to collaborate effectively with people of diverse cultures compared to their humanities and social sciences counterparts. This suggests that STEM students may struggle to establish deeper intercultural relationships, even while their proficiency in communicating across cultural boundaries was notably higher. Such findings may reflect the presence of universal frameworks in STEM, such as mathematical or technical terminology, which facilitate cross-cultural interaction without requiring extensive linguistic or cultural immersion.

Moreover, Takenaga and Yamada (2019) suggested that STEM students displayed greater confidence in applying their expertise to new fields, a result that aligns with the field's methodological emphasis on adaptability and innovation. They also outperformed their humanities/social sciences peers in demonstrating action informed by strong judgment and conviction, likely due to the STEM disciplines' reliance on empirical evidence and data-driven reasoning. Lastly, in terms of interdisciplinary

knowledge acquisition, STEM students reported a stronger grasp of social sciences and information sciences, while humanities/social sciences students found STEM knowledge more challenging to assimilate.

In terms of study habits, Iñigo (2018) examines the concept of learner autonomy among Filipino college students from liberal arts and natural sciences disciplines, focusing on their beliefs, practices, and perceptions in the context of English language learning. The study highlights that while both groups acknowledge the value of learner autonomy in enhancing second language acquisition, liberal arts students tend to prioritize independence and self-regulation, whereas natural sciences students place greater emphasis on collaboration and the identification of personal strengths and weaknesses.

Furthermore, the differences between humanities and science students may extend to how they approach learning English during their school education. For example, Vahdany (2015) investigated the effectiveness of a general English textbook used at Payame Noor University by examining student perceptions and academic outcomes across the humanities and sciences. While humanities students demonstrated a more favorable attitude toward the textbook's content, science students were more critical, believing it did not align with their specific academic needs. Nevertheless, science students outperformed their humanities counterparts on the final exam, a result attributed to their stronger familiarity with English and adaptability to standardized assessments.

In countries where the distinction between the humanities and sciences exists, the classification does not necessarily align with that of Japan. In China, for instance, within the framework of the Gaokao university entrance examination system, Chinese (National Language), mathematics, and a foreign language constitute the core curriculum, while social studies are categorized under humanities, and natural sciences encompass the scientific disciplines. Presently, students are required to select three subjects from these two groups, which collectively comprise six disciplines (Makanzhuo, 2023). Moreover, high school textbooks are also designed with a strong awareness of interdisciplinarity (Liang, 2024). From this, it can be inferred that English is moving in a direction where it is not merely a part of an academic discipline but rather something that encompasses multiple fields.

Despite extensive research on differences in language use, learning approaches, and academic structures between the humanities and sciences, a clear understanding of how these distinctions shape the role of English as a subject remains elusive. Existing studies often present nuanced or even conflicting findings, underscoring the complexity of this issue.

Given these considerations, it is essential to explore how students' subject preferences, influenced by their curricular experiences, inform the academic conceptualization of English. Accordingly, this study examines the conceptualization of English through students' preferences for various subjects within school curricula—broadly, natural science subjects include mathematics and sciences; humanities subjects encompass Japanese language (as the national/L1 language) and social studies; and practical subjects include physical education (P.E.)—with the aim of clarifying its broader role in the educational landscape.

3. Method

In this study, survey data were analyzed to examine the property of English (as a second language) by investigating the preferences of 793 university students in Japan regarding various academic subjects. The data were collected between 2021 and 2024 through informal surveys conducted during the initial English classes at five private universities in Japan (face-to-face instruction). These institutions are generally regarded as having academic levels ranging from average to slightly above average, based on standard score metrics.

The surveys were designed to fulfill multiple purposes: to assess students' academic abilities and educational backgrounds, introduce them to Google Forms, and ease any anxiety they might have regarding university-level English education. Additionally, the surveys aimed to challenge students' preconceptions about the subject, demonstrate the instructor's willingness to engage with their perspectives, and identify the unique attributes of English as a subject, including areas where students excel or require further support.

To ensure confidentiality, the collected data were immediately anonymized and securely stored, with their use limited to educational self-improvement. The survey examined students' preferences across 20 core subjects studied from elementary to high school, excluding those less frequently emphasized in written entrance exams. These subjects included Japanese language (as the national and native language), Japanese classics, Chinese classics, Arithmetic, Mathematics, Social Studies, Geography, Japanese History, World History, Contemporary Society, Science, Physics, Chemistry, Biology, Earth Science, English (as ESL), Physical Education, Art, Home Economics, and Technical Arts. Although the survey also collected information about participants' English-related qualifications, this aspect falls outside the scope of the current study and will not be discussed further.

Participants provided responses by selecting the option that best reflected their preference for each subject, such as "I like it." Given the straightforward format, it is assumed that the responses represent the participants' genuine preferences. The survey employed a 5-point Likert scale, ranging from "strongly like" to "strongly dislike," and the data were analyzed using factor analysis.

For the purposes of factor analysis, this study employed R version 4.4.2 for Windows, generating visual presentations that were manually adjusted using Paint to address instances of truncation in the figures, while ensuring that critical elements such as numbers and text remained unaltered. To assess the suitability of the data for factor analysis, the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity were conducted. The KMO measure of sampling adequacy was 0.79, indicating that the dataset was appropriate for factor analysis. Furthermore, Bartlett's test of sphericity yielded $\chi^2(19) = 125.51$, $p < 2.2\times10\text{-}16$, suggesting that the correlation matrix was not an identity matrix. These results confirmed that factor analysis was appropriate for this dataset.

Moreover, as the data also includes the English proficiency level, we conducted a regression analysis to explore the influence of subject preferences on English proficiency in order to gain a deeper insight into how English is perceived as an academic discipline.

Proficiency in this study was primarily assessed using the EIKEN test as the central criterion. This choice reflects EIKEN's strong alignment with Japan's English education system and its widespread recognition among students. Table 1 outlines the proficiency levels used in this study, their corresponding EIKEN levels, and concise descriptions provided by EIKEN. As EIKEN establishes learning and achievement benchmarks corresponding to junior and senior high school graduation, it serves not only as a common target for students but also as a valuable reference for educators.

The table also includes comparisons with the CEFR framework. However, due to the broad range covered by CEFR A1, EIKEN's more granular level distinctions are particularly advantageous for analyzing Japanese learners. For example, for junior high school students, while achieving EIKEN Grade 5 (classified within CEFR A1) may have minimal impact on self-confidence, attaining EIKEN Grade 3—also within CEFR A1—can significantly enhance a learner's confidence. This distinction underscores EIKEN's utility in providing more nuanced insights into the relationship between proficiency and self-confidence in the context of Japanese learners. As for other English qualifications, MEXT provides a comparative framework of EIKEN and other proficiency tests (Appendix A).

In cases where students did not report their EIKEN level or where alternative test results were deemed more indicative of their current proficiency (e.g., a student reporting EIKEN Grade 5 but achieving a TOEIC score of 600, possibly reflecting an earlier acquisition of EIKEN Grade 5 during junior high school, followed by a lack of subsequent certifications until taking the TOEIC at university), the latter results were adopted to determine their proficiency level in this study. This approach ensures that the analysis is based on the most accurate and contextually relevant measures of the students' linguistic abilities. Building upon this definition, Table 2 delineates the proficiency levels of 793 students. The value 0 at Level denotes a 'no answer' response and there were no students at proficiency level 7 (CEFR C).

Using English proficiency as the dependent variable, we estimated the regression coefficients for preferences across different academic fields, using the 707 data, excluding the 86 cases of zero, 'no answer.' Prior to conducting the regression analysis, diagnostic tests were performed to assess the validity of the model assumptions. Multicollinearity was evaluated using the variance inflation factor (VIF). The results indicated that all predictor variables had VIF values below 5, with the highest being 2.55, suggesting that multicollinearity was within an acceptable range. The normality of residuals was examined using the Shapiro-Wilk test ($W = 0.958$, $p < 0.001$), indicating that the residuals deviated significantly from a normal distribution. However, given the large sample size ($n = 707$), the central limit theorem ensures that the violation of normality does not substantially impact the reliability of ordinary least squares (OLS) estimates. Homoscedasticity was assessed using the Breusch-Pagan test ($\chi^2(20) = 24.936$, $p = 0.204$), which indicated no significant heteroscedasticity. Since the assumption of homoscedasticity was not violated, the use of robust standard errors or robust regression was deemed unnecessary. Potential outliers were examined using Cook's Distance (Appendix B). The plot revealed that all Cook's D values were below 0.025, far from the common threshold of 1.

Table 1. Relationship between proficiency levels in this study and Eiken grades

Level	EIKEN	CEFR	Example of recognition/use
7	1	C1	International admissions to graduate and undergraduate programs; MEXT benchmark for English instructors (Pre-1)
6	Pre-1	B2	
5	2	B1	MEXT benchmarks for high school graduates
4	Pre-2	A2	
3	3	A1	MEXT benchmark for junior high school graduates
2	4		-
1	5		

*This table was created based on the chart by the Eiken Foundation of Japan, extracting the necessary parts and adding the level designations used in this study.

Table 2. The number of students corresponding to each proficiency level

Proficiency	0	1	2	3	4	5	6	7
N	86	16	19	146	273	246	7	0

M=3.60, SD=1.54

This suggests that no individual data points exerted excessive influence on the regression model. Given these diagnostic results—specifically, the absence of severe multicollinearity, heteroscedasticity, or influential outliers, and the sufficiency of the sample size— OLS regression was selected as the most appropriate analytical method.

4. Results and discussion

Figure 1 illustrates the scree plot in this factor analysis. Based on the eigenvalues, the first four factors exhibit substantially higher eigenvalues than the random baseline (or "elbow point," where the decline in eigenvalues becomes markedly less steep), underscoring the appropriateness of a four-factor model to account for the latent structure of the data.

In other words, the first factor, with an eigenvalue of approximately 4.0, explains the largest proportion of the variance, capturing the most prominent underlying dimension. The second, third, and fourth factors also contribute meaningfully to the explanation of shared variance. However, beyond the fourth factor, the eigenvalues approach or fall below those of the random data, suggesting that these additional factors primarily represent idiosyncratic noise or unique variance rather than substantive shared structures. Taking these considerations into account, the results of the factor analysis conducted on the twenty subjects are explained.

Figure 2 illustrates the two-factor model. In this model, factor 1 is associated with subjects related to Japanese language and social studies, while factor 2 is linked to mathematics and science. This suggests that factor 1 can be interpreted as representing the humanities, and factor 2 as representing the sciences. The crucial point here is that English does not exhibit a significant association with either factor. This implies that it may be premature to categorize English solely within the conventional humanities-sciences framework.

Examining the three-factor model (Figure 3), it becomes apparent that factor 1 corresponds to the humanities, while factor 2 represents the sciences. Factor 3, by contrast, encompasses subjects such as home economics, art, technology, and physical education, which can be interpreted as practical or non-assessment-driven disciplines.

Of particular note is that English remains unaligned with any of the three factors. As for the relationships among the factors, factors 1 and 2 are both connected to factor 3, yet there is no direct relationship between factors 1 and 2. This suggests that the grouping of subjects reflected in these factors aligns with the courses likely undertaken by students specializing in either the humanities or the sciences, particularly in preparation for their university entrance examinations in their intended major.

Figure 3. Three-Factor Model (with loadings below 0.3 omitted)

Figure 1. Scree Plot of Factor Analysis: Comparison of Actual, Simulated, and Resampled Data

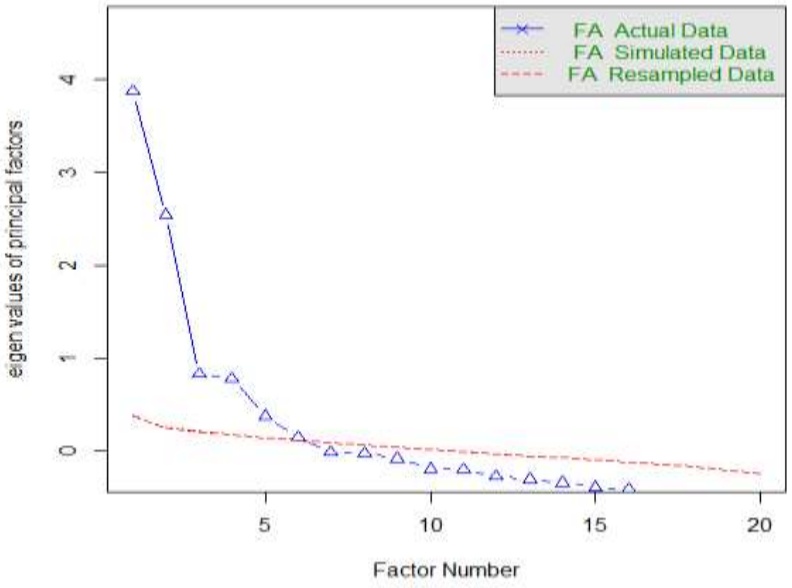
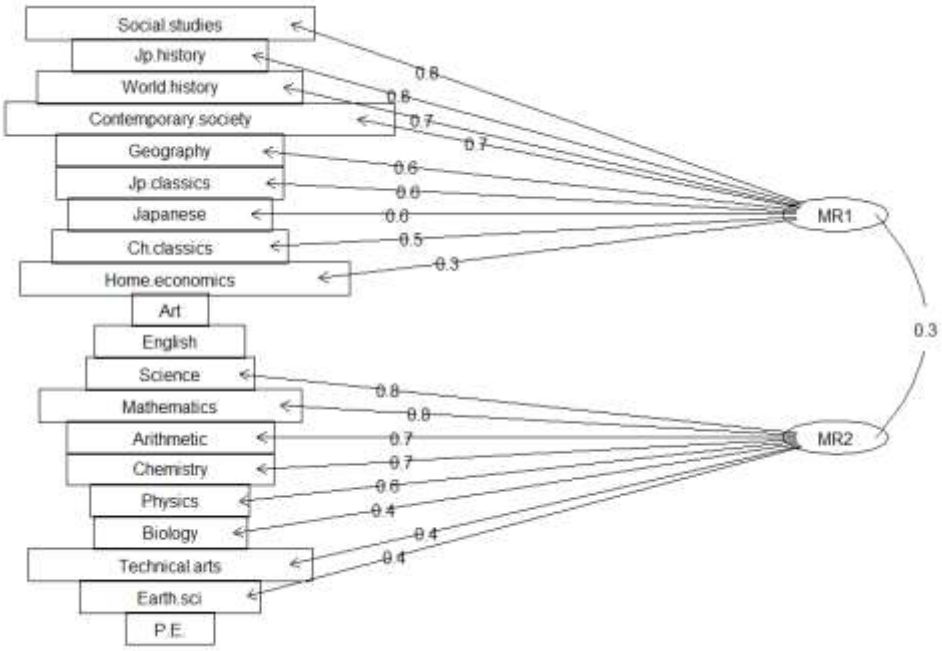


Figure 2. Two-Factor Model (with loadings below 0.3 omitted)[1]



[1] A threshold of 0.3 for factor loadings is a widely accepted standard in factor analysis, serving as a practical criterion to identify meaningful relationships between variables and latent factors.

Figure 3. Three-Factor Model (with loadings below 0.3 omitted)

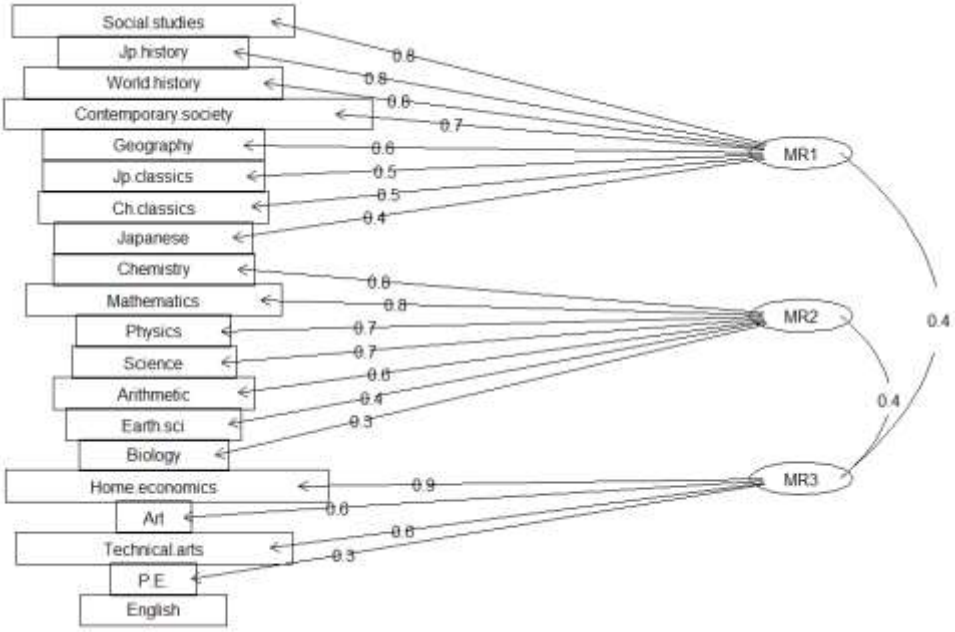
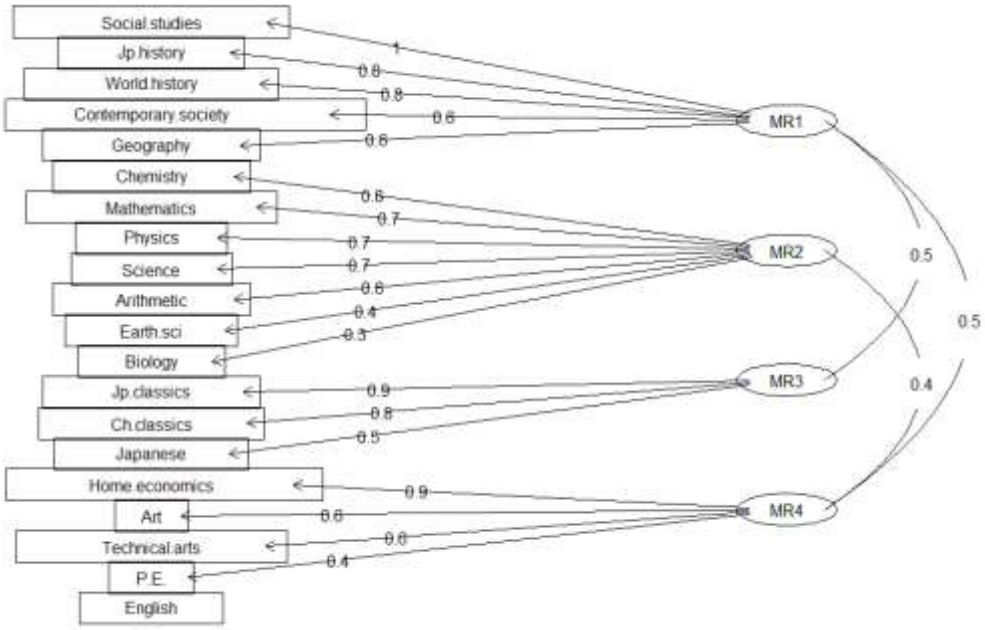


Figure 4 illustrates the four-factor model, where the sciences (factor 2) and practical subjects (factor 4) remain intact, while the humanities are further subdivided into social studies (factor 1) and Japanese language (factor 3). This subdivision likely reflects a nuanced distinction within the humanities, with Japanese representing a subject rooted in everyday activities and social studies embodying a more academically oriented discipline.

The relationships among the factors also appear logically coherent within this framework. Notably, however, English continues to stand alone, remaining unaligned with any specific factor.

Figure 4. Four-Factor Model (with loadings below 0.3 omitted)

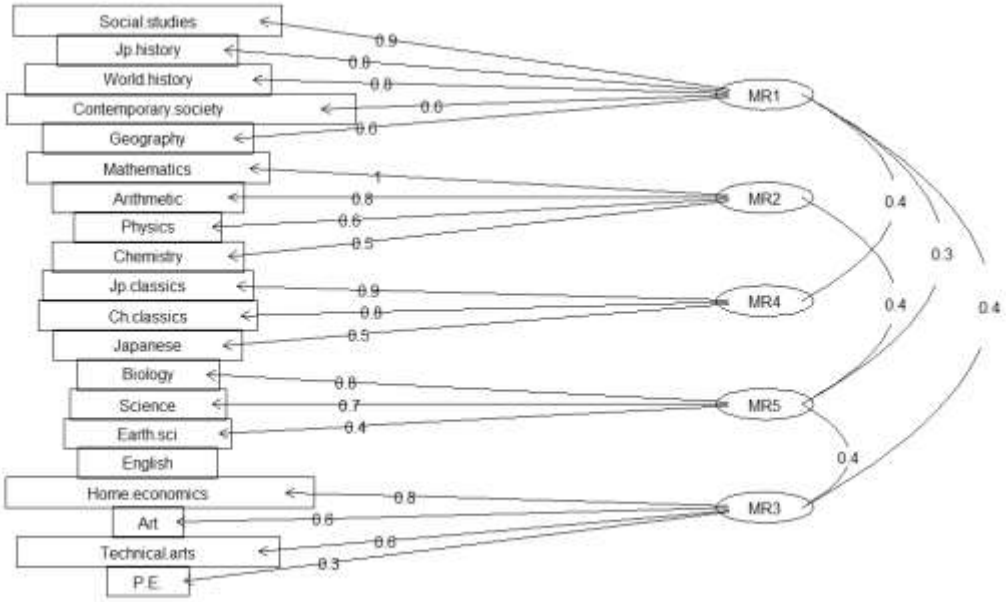


The eigenvalues indicate that the four-factor model remains a reasonable solution; however, as English has yet to align with any factor, further exploration is necessary. In the five-factor model (Figure 5), the sciences are now delineated into two distinct factors. Factor 2 comprises mathematics, arithmetic, physics, and chemistry, while factor 4 includes biology, earth science, and

general science. This suggests that factor 2 represents a more specialized subset of science subjects—those typically selected by students on a science-oriented track—whereas factor 4 encompasses science subjects that are more broadly accessible to both humanities and science students.

For example, humanities students may be required to select science subjects for examinations, in which case they are more likely to choose subjects classified under factor 4. This interpretation is further supported by the relationships observed among the factors, which appear both logical and consistent. However, even when considering the perspective of distinct subject choices between the humanities and sciences, English remains unassociated with any factor. Meanwhile, factor 1 continues to represent social studies, factor 3 corresponds to Japanese language, and factor 5 reflects practical subjects.

Figure 5. Five-Factor Model (with loadings below 0.3 omitted)



In the six-factor model (Figure 6), the science-related subjects grouped under a single factor in the five-factor model have been further differentiated. Mathematics and arithmetic are now explained by a distinct factor (factor 2), while science subjects specific to the sciences are represented by factor 6. Factor 1 continues to represent social studies, factor 3 practical subjects, factor 4 Japanese language, and factor 5 more general science subjects.

Even in this model, English remains unassociated with any factor. An additional noteworthy observation is that physical education also loses its connection to the factors. Consequently, factor 3 appears to encompass practical subjects closely tied to everyday life, whereas physical education might be better understood as involving more intentional or structured activities. It is possible that English exhibits a similar characteristic, reflecting a comparable nature in its independence from the factors.

Figure 6. Six-Factor Model (with loadings below 0.3 omitted)

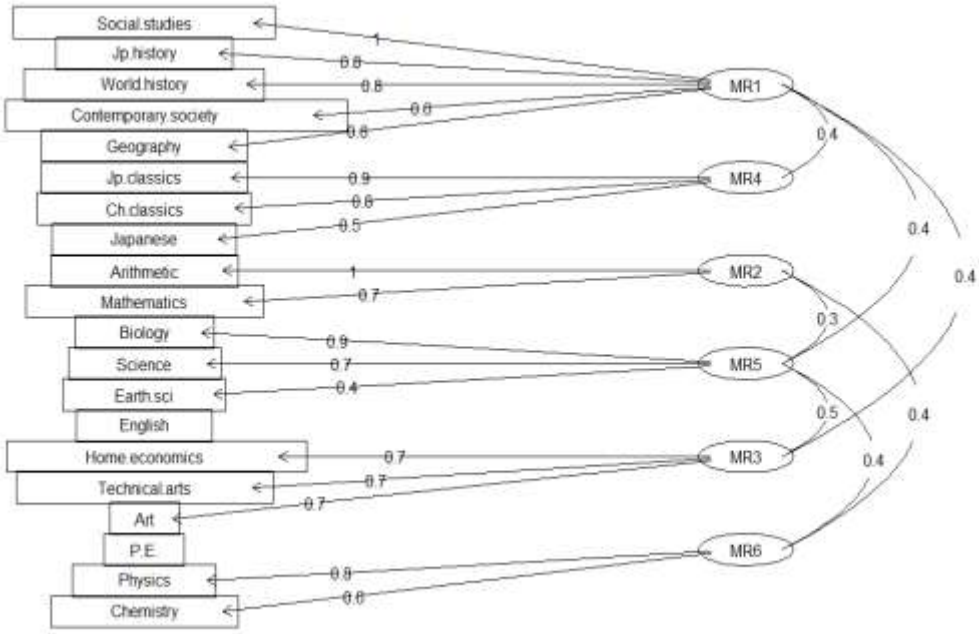


Figure 7. Seven-Factor Model (with loadings below 0.3 omitted)

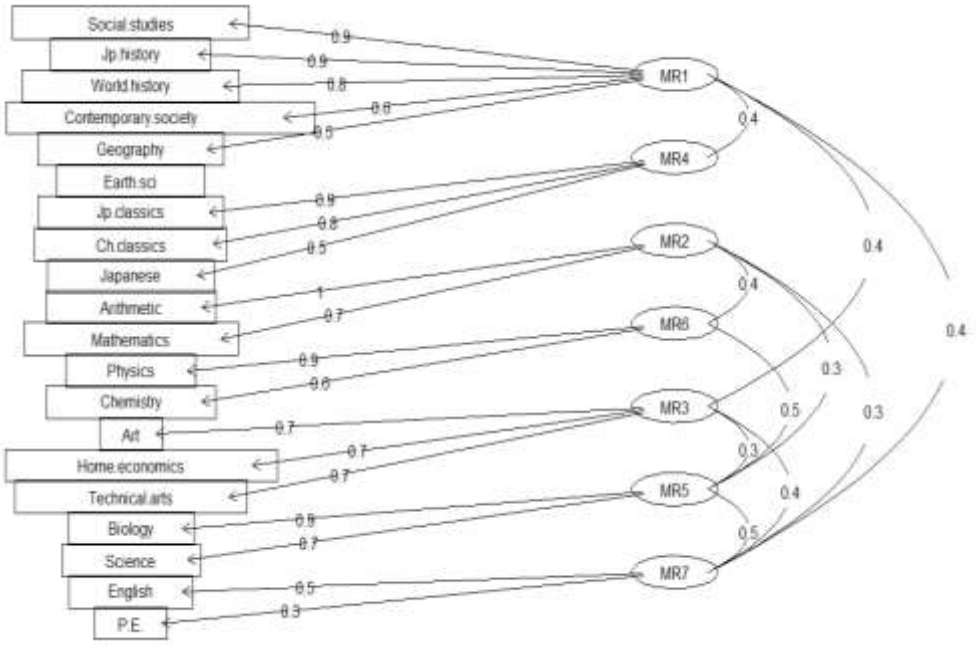


Figure 7 presents the seven-factor model, in which a factor strongly associated with English has finally emerged. This will serve as the focal point of the discussion moving forward. The factor scores are summarized in Table 3. In this model, factor 1 corresponds to social studies, factor 2 to mathematics, factor 3 to practical subjects, factor 4 to Japanese, factor 5 to general science, and factor 6 to science subjects specific to the sciences. Notably, earth science is excluded, which can be interpreted as a reflection of its low enrollment and, consequently, its limited significance in the analysis.

The key question is how to interpret factor 7, which is associated with both English and physical education. The simplest explanation would be to classify it as a residual category—"miscellaneous subjects"—encompassing disciplines that do not fit neatly into the other established groupings. The exclusion of earth science from this category can be explained by its limited enrollment, which renders it less visible or relevant.

Another possible interpretation is that English and physical education are both subjects requiring intentional practice. Physical activity, while an everyday occurrence, becomes a deliberate and structured effort in the context of physical education. Similarly, although language use is a part of daily life, the study and use of English involve conscious learning and purposeful application: The university students in this study belong to a generation that typically began learning English around the fifth grade of elementary school. While some may have been exposed to English prior to the critical period,[2] elementary school English education at the time comprised only 35 hours of instruction per year.[3] At the junior high school level, the curriculum initially allocated 105 hours of English instruction per year.[4] Such very limited exposure is far from sufficient to suggest that they had acquired English as a first language.

Table 3. The Factor Score Table for the Seven-Factor Model

	MR1	MR2	MR3	MR4	MR5	MR6	MR7	h2	u2	com
Japanese language	0.15	0.03	0.16	0.47	0.05	-0.22	-0.06	0.4	0.6	2
Japanese classics	-0.02	0.03	0.01	0.9	-0.07	0.09	0.1	0.8	0.2	1.1
Chinese classics	-0.03	0.07	-0.06	0.84	0	0.1	0.12	0.69	0.31	1.1
Arithmetic	0.01	0.99	-0.05	0.09	0.06	0	-0.16	0.88	0.12	1.1
Mathematics	-0.02	0.69	-0.03	0.03	-0.03	0.33	-0.12	0.7	0.3	1.5
Social studies	0.92	0.07	-0.14	-0.02	-0.06	-0.12	0.11	0.8	0.2	1.1
Geography	0.55	0.02	-0.04	-0.03	0.07	0.02	0.27	0.49	0.51	1.5
Japanese history	0.87	0.01	0	0.01	-0.01	0	-0.27	0.67	0.33	1.2
World history	0.83	-0.11	0.07	-0.05	0	0.1	-0.24	0.64	0.36	1.3
Contemporary society	0.61	0.03	-0.01	0.09	-0.09	-0.04	0.11	0.45	0.55	1.2
Science	-0.08	0.17	0	-0.01	0.68	0.19	-0.03	0.72	0.28	1.3
Physics	-0.02	0.06	0.09	0.02	-0.24	0.87	0.04	0.66	0.34	1.2
Chemistry	-0.03	0.06	-0.02	0.05	0.2	0.59	0.02	0.55	0.45	1.3
Biology	-0.07	-0.03	0.03	-0.03	0.94	-0.22	-0.01	0.69	0.31	1.1
Earth science	0.26	-0.09	0.02	0.01	0.26	0.24	0.14	0.37	0.63	3.8
English	-0.07	-0.11	-0.03	0.09	0	0.04	0.45	0.17	0.83	1.3
P.E.	0.03	0.15	0.19	-0.13	-0.02	-0.07	0.3	0.24	0.76	2.9
Art	-0.06	-0.11	0.71	0.06	0.04	0.03	-0.12	0.43	0.57	1.1
Home economics	-0.03	0.09	0.7	0.04	0.02	-0.14	0.11	0.6	0.4	1.2
Technical arts	0.03	-0.03	0.69	-0.06	-0.04	0.23	0.02	0.52	0.48	1.3

Although this reasoning may not be entirely compelling, it might also be argued that both subjects share a physical dimension: physical movement in physical education and the physical articulation of speech in English. While this perspective may appear somewhat tenuous, it remains a consideration.

In any case, the association of English and physical education with factor 7 appears to represent a tentative finding rather than a definitive conclusion and should be regarded as provisional at this stage.

[2] See Hartshorne, et al (2018) for a detailed discussion on this topic.

[3] Since 2020, the elementary school curriculum has been structured to include 35 hours of English instruction per year for third and fourth graders, and 70 hours per year for fifth and sixth graders.

[4] Since the 2020 academic year, this has been expanded to 140 hours per year.

4.1 The correlation between English proficiency and subject preferences in academic disciplines

The results of the OLS regression analysis are presented in Table 4. The regression analysis yielded an intuitively expected result, demonstrating a significant relationship between preference for English and English proficiency. The regression coefficient for English preference was notably higher than those of other subjects, suggesting a meaningful association with English ability. In contrast, preferences for other academic subjects exhibited negligible regression coefficients, and none of these variables had a statistically significant impact on English proficiency. This indicates that there is no discernible relationship between preferences for non-English subjects and English ability.

These findings underscore the idea that an affinity for English naturally correlates with higher proficiency in the language, whereas preferences for other subjects do not appear to be relevant determinants of English ability. Therefore, irrespective of disciplinary boundaries between the natural sciences and the humanities, students' actual proficiency in English appears to be most profoundly influenced by their intrinsic affinity for the language itself. However, as discussed above, the categorization of English within a particular academic domain does not seem to be significantly dictated by the conventional division between the sciences and the humanities.

Table 4. Results of Regression Analysis Significance levels: $^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$

Variables	β	SE	t	p
Intercept	3.509178	0.207756	16.891	$2.00 \times 10^{-16***}$
English	0.279685	0.033426	8.367	$3.30 \times 10^{-16***}$
Science	0.077482	0.045569	1.7	0.0895
Home economics	0.074688	0.040025	1.866	0.0625
Contemporary society	0.031235	0.039445	0.792	0.4287
Geography	0.030758	0.040222	0.765	0.4447
Biology	0.027413	0.035703	0.768	0.4429
Arithmetic	0.024005	0.042807	0.561	0.5751
World history	0.019891	0.041145	0.483	0.6289
Chemistry	-0.00188	0.040258	-0.047	0.9628
Art	-0.00298	0.033112	-0.09	0.9283
Japanese	-0.01474	0.038955	-0.378	0.7053
Japanese history	-0.01964	0.041466	-0.474	0.636
Physics	-0.02238	0.039419	-0.568	0.5704
Chinese classics	-0.02417	0.047695	-0.507	0.6125
Japanese classics	-0.0373	0.050277	-0.742	0.4584
P.E.	-0.04215	0.031069	-1.357	0.1754
Earth science	-0.04564	0.041745	-1.093	0.2747
Technical arts	-0.06791	0.038674	-1.756	0.0796
Mathematics	-0.06965	0.043228	-1.611	0.1076
Social studies	-0.07126	0.049815	-1.43	0.153

4.2 Educational implications

What can be inferred about English as a subject based on these findings? Among the students surveyed in this study, preferences for English appear to be largely independent of preferences for other subjects. In other words, neither humanities- nor science-oriented students demonstrate a particular predisposition toward English. Moreover, preference for English seems to correlate with perceived proficiency. Therefore, it cannot be definitively stated that English belongs to either the humanities or sciences, nor that students from one group exhibit greater aptitude for English than the other.

As previously discussed, the Japanese curriculum has expanded its English education by introducing it earlier in compulsory education and increasing the breadth of its content. However, Erikawa (2024) observes that this curricular expansion has placed a considerable burden on both students and teachers, exacerbating disparities in academic achievement.

In this sense, as the scope of instruction broadens, it is imperative to devise more sophisticated and effective pedagogical approaches—ones that transcend the conventional dichotomy between the natural sciences and humanities, fostering a more holistic and integrative perspective on English education.

Conversely, this suggests that a student's chosen academic specialization does not confer any decisive advantage or disadvantage in acquiring English proficiency. Furthermore, as illustrated in Figure 7, factor 7 shows broad connections with other factors representing distinct subject groups. This implies that English may benefit from a multidisciplinary approach, highlighting its potential as a subject that transcends traditional academic boundaries.

In this regards, Volkova et al. (2019) suggest that interdisciplinary education serves as a powerful approach to achieving holistic educational outcomes, equipping students with the adaptability and integrative thinking required to confront multifaceted global challenges.

In this context, English can be seen as a key factor, not only because it bridges various academic disciplines but also because it stands to benefit from the development of skills across different subjects. This highlights the potential for students, regardless of whether they are oriented toward the humanities or sciences, to approach English with a sense of optimism and purpose, fostering the expectation that their abilities can improve through dedicated effort.

Even for students who excel in subjects seemingly distant from traditional desk-based learning, such as P.E., the shared element of intentional practice may provide a meaningful entry point for engaging with English. This suggests that students from all academic backgrounds have the opportunity to connect with English in ways that align with their strengths, enabling them to enhance their proficiency through deliberate and focused learning.

At the same time, Hashimoto (2008) argues that language education is similar to biology and earth science: language learning faces challenges such as the difficulty of teaching grammar systematically due to numerous exceptions and its limited practical benefits, like biology and earth science, and it is regarded as a "weak necessity" and lacks "universal enjoyment." The relationship can indeed be observed through the factor scores. Sakai (2007) argues the motivation to study English, particularly in sustaining students' interest across all stages of learning—from pre-beginner to advanced—often incorporating elements of entertainment, is essential for fostering long-term engagement and success.

Therefore, it is important to remain mindful that negative perceptions of other subjects may also have an influence. As an initiative that bridges the divide between the humanities and natural sciences—one that also holds the potential to positively influence English learning, Kazawa and Sando (2012) proposed three key principles: participatory learning, where students begin with their interests and gradually connect to foundational knowledge; scientific literacy, which fosters an understanding of the interplay between science, technology, and society while enabling students to articulate informed perspectives; and contextualized education, which grounds scientific concepts in real-world issues and everyday experiences to ensure learning is meaningful, practical, and socially relevant.

Regarding this matter, Li and Wen (2024) demonstrated through their research on the CLIL curriculum in China that English education is shifting away from a primary focus on grammar, vocabulary, and sentence structure. Instead, increasing attention is being given to integrating subjects such as natural sciences, geography, humanities, and other related disciplines into English instruction. More importantly, this approach aims to continuously strengthen students' English communication skills, allowing them to fully utilize the language as an effective tool for communication. There are undoubtedly educators in Japan who share this perspective. However, if such initiatives were actively pursued, English education, which has traditionally been framed within the dichotomy of natural sciences and humanities, could be improved as this long-standing binary approach has often constrained students, leading to learning stagnation or a decline in motivation. Shedding light on this issue may pave the way for a more flexible and effective educational framework. This also aligns with Volkova et al. (2019), who underscore the significance of integrating natural sciences and the humanities, in particular within school curricula as a means to elevate the quality of education and cultivate students' intellectual and creative capacities.

4.3 Limitations of the study

This study has certain limitations, primarily due to its focus on Japanese university students, whose preferences are deeply shaped by the structure of Japan's educational curriculum. Consequently, the findings may not be directly applicable to contexts

where foreign language education operates under different paradigms. Further research in diverse educational settings, particularly in regions with distinct approaches to language education, would provide more comprehensive and accurate insights. Moreover, the participants in this study represent a broadly average academic demographic. It is possible that administering the same survey to learners at either exceptionally high or low proficiency levels could yield differing results.

Despite these limitations, this study provides valuable contributions to the field of English education and curriculum development. The findings offer meaningful insights that can inform instructional practices, enhance curriculum design, and support more effective educational strategies, ultimately benefiting both educators and students.

5. Conclusion

This study examined the positioning of English as a subject within the broader academic framework by analyzing university students' preferences across various disciplines using factor analysis. The findings reveal that English does not fit neatly within the conventional dichotomy of humanities and sciences, instead occupying a distinctive position that transcends traditional academic boundaries. Preferences for English appear largely independent of other subjects.

In the seven-factor model, a factor which links English with physical education emerges. It suggests that English may be best conceptualized as a subject requiring intentional practice. This attribute situates English within a broader educational context, highlighting its inherently interdisciplinary nature. By adopting a multidisciplinary approach, English education can leverage the strengths of diverse academic disciplines, enabling students across all fields to develop proficiency through deliberate and focused learning.

From an educational perspective, these findings emphasize the potential of English as a unifying subject that bridges the divide between the humanities and sciences. They suggest that students, regardless of their academic specialization, can engage with English in meaningful and impactful ways. Integrating approaches such as participatory learning, scientific literacy, and contextualized education may further enrich English language learning, fostering connections between language acquisition, real-world applications, and interdisciplinary understanding.

Despite the challenges, particularly in overcoming negative perceptions of English and its perceived lack of practical value, integrating English into interdisciplinary educational frameworks offers a significant opportunity to cultivate students' intellectual and creative capacities. This approach aligns with broader educational objectives, equipping learners with the adaptability and integrative thinking required to tackle complex global challenges. Thus, English functions not only as a linguistic skill but also as a pivotal element in promoting holistic and transformative educational outcomes.

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Appendix A. Comparison of certification standards and CEFR proficiency levels (MEXT, 2018; Japanese expressions translated into English)

CEFR	Cambridge English Qualifications	EIKEN	GTEC Advanced Basic Core CBT	IELTS	TEAP	TEAP CBT	TOEFL iBT	TOEIC L&R/ TOEIC S&W
C2	230 200			9.0 8.5				
C1	199 180	3299 2600	1400 1350	8.0 7.0	400 375	800	120 95	1990 1845
B2	179 160	2599 2300	1349 1190	6.5 5.5	374 309	795 600	94 72	1840 1560
B1	159 140	2299 1950	1189 960	5.0 4.0	308 225	595 420	71 42	1555 1150
A2	139 120	1949 1700	959 690		224 135	415 235		1145 625
A1	119 100	1699 1400	689 270					620 320

Appendix B. The Cook's Distance plot output for regression analysis