

Comprehension Gains through Translation: An Experimental Study

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ABSTRACT

Language problems can hinder the understanding of academic texts for international and immigrant students in higher education. This study examined whether an integrated translation element in the course syllabus improves comprehension and engagement. Using a between-subjects experimental design, participants were randomly assigned to either an English-only syllabus or a translated version. Upon completion of the reading, participants undertook a comprehension assessment and evaluated their perceived understanding and translation precision. An independent samples t-test indicated a statistically significant difference in comprehension, with the Translated Group obtaining a mean quiz score of 4.50 (SD = 0.55) vs the English-Only Group's 2.40 (SD = 1.52), $p < .05$. The findings indicate that access to translated academic texts significantly enhances comprehension and perceived understanding for non-native English speakers. This facilitates the incorporation of translation tools in digital learning systems like MyCourses to enhance accessibility and diminish cognitive strain.

1. INTRODUCTION

Understanding course syllabi is vital for academic success; nevertheless, language issues sometimes impede international and immigrant students from obtaining crucial course information. In American schools, many learning management systems (LMS), such as MyCourses, are largely tailored for English speakers, which can disadvantage non-native English users in understanding assignments, deadlines, or grading criteria. Previous studies have shown that reading in a foreign language requires increased cognitive effort, especially when the material includes unfamiliar vocabulary or technical jargon [1, 2]. These problems may result in diminished understanding and heightened anxiety when engaging with academic subjects [2].

This study analyzes if the introduction of a translation element into course syllabi can boost comprehension for international students. Drawing on studies in attention-guided reading and translation interface design, the experiment contrasts two separate groups: one utilizing an English-only syllabus and the other employing a translated version. By examining quiz-based Using

comprehension scores and self-reported knowledge, this research evaluates whether translation significantly increases comprehension and learning confidence. A between-subjects experimental design guarantees that no participant undergoes both conditions, thereby reducing learning effects. The hypothesis posited that international or immigrant students reading a course syllabus translated into their native language will attain superior comprehension scores on the syllabus quiz compared to those reading the English-only version.

2. METHODS

2.1 Study design

This experimental design utilized a between-subjects approach to test our hypothesis: Immigrant/International students assigned to the Translated RIT class syllabus condition will achieve a significantly higher comprehension score on the syllabus quiz compared to students assigned to the English-only condition. Each participant was randomly assigned to one of two conditions: Translated group or English-only group. Using a between-subjects approach instead of a within-subjects allowed us to eliminate the chance of a learning effect. The independent variable in this study is the language condition with two levels representing the groups we are testing on: English-only group and Translated group. The primary dependent variable is the comprehension score on the syllabus quiz to measure understanding of key course information. The secondary dependent variables are perceived understanding based on the scale rating of 1-5 from poor to excellent on how they understood the syllabus in their assigned group, and perceived accuracy of the translation from a scale of 1-5 from not accurate to really accurate.

2.2 Participants

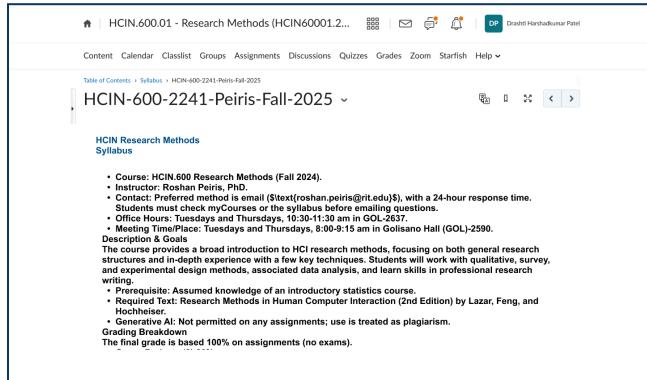
A total of 11 participants took part in the study. The participants were RIT undergraduate and graduate students that were recruited through peers and in class testing. The sample of students representing different native language backgrounds was English (n = 5), Hindi (n = 3), Spanish (n= 2), and Bengali (n = 1).

2.3 Procedure

Each participant was assigned a syllabus in English or their native language. They were instructed to read the syllabus and take a comprehension quiz consisting of 5 multiple choice questions. After completion of the quiz, the participants were asked to fill out a follow-up question survey that allowed them to free-type their opinions and self-rate their understanding and translation accuracy through a Google form.

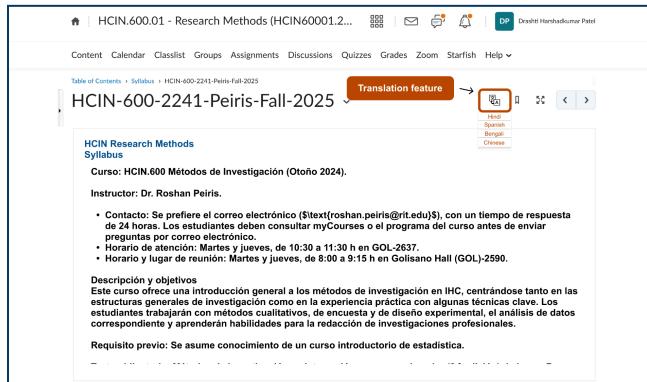
2.3.1 Apparatus

The study was conducted using a laptop computer running a Figma prototype designed for the experiment. The prototype consists of a RIT MyCourse webpage that presents the course syllabus with a feature that allows it to display either the English or the translated version.



The screenshot shows a RIT MyCourse page for 'HCIN.600.01 - Research Methods (HCIN60001.2...)' with a 'Translation feature' button highlighted. The page content includes course details, a syllabus section, and a 'Translation feature' button.

Figure A. English syllabus



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Figure B. Translated Spanish syllabus

2.4 Statistical Analysis

Descriptive statistical analysis was conducted to evaluate the effect of language condition on syllabus and participants' quiz scores. Descriptive statistics include the

number of participants (N), mean, median, standard deviation, minimum, and maximum values for quantitative questions measures. The Quiz scores were done calculating the median and average score in each language group, followed by compilation of the mean score and standard deviation. An independent sample t-test was conducted to compare the mean quiz comprehension scores between the English group and native language translation groups. The t-statistic and P-value (one-tailed) were calculated based on the mean scores of the two independent groups to test the hypothesis that reading a translated language syllabus would achieve a higher comprehension score.

3. RESULTS

3.1 Comprehension quiz scores

Between-subjects quiz results

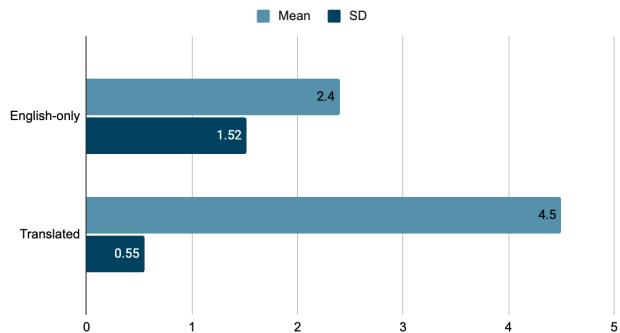


Figure C. Mean comprehension score by treatment group (English-only vs. Translated)

This study's data analysis revealed a significant positive effect of the translation feature on participant comprehension. The mean quiz score for the English-only group ($n=5$) was a 2.40 out of 5, with a standard deviation of 1.52. The mean quiz score for the Translated group ($n=6$) was a 4.50 out 5, with a standard deviation of 0.55. Figure C illustrates the proportionate difference, showing a distinct spike in comprehension for the translated group relative to the English-only group. An independent sample t-test was conducted and found a statistically significant difference in mean quiz scores between the groups, $t(7.02) = -2.94$, $p < 0.05$ (0.017). This offers strong evidence to support the hypothesis that a translation feature would significantly enhance the comprehension of academic content for non-native English speakers.

3.2 Performance and perception

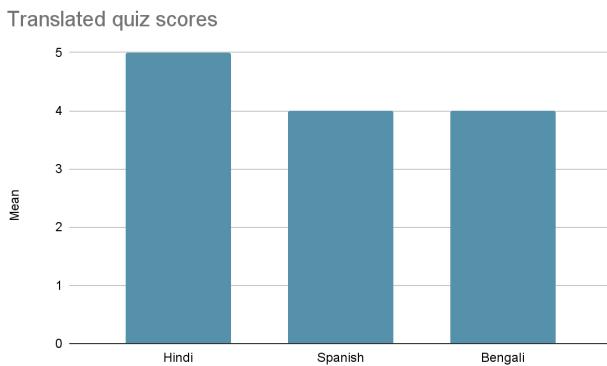


Figure D. Mean comprehension score by specific language group (Translated condition)

This study used the translation of multiple languages (Bengali, Hindi, and Spanish) from Google translate. We were interested in how efficient this translation software was to those who are fluent in the language to understand if this could've affected the scores. The Hindi group ($n=3$) had a mean score of 5 ($SD=0$), the Spanish group ($n=2$) had a mean score of 4 ($SD=0$), and the Bengali participant got a score of 4. As depicted in figure D, there wasn't a huge difference between the mean scores of the 3 translations. On the other hand, these results do show that the Hindi translation was particularly effective as it led to a perfect average score despite it having the most participants. Overall, all 3 translations performed significantly better than the English-only control group. After completing the quiz, participants were asked to complete a follow-up survey to understand their thoughts of the study. They were asked to rate their perceived understanding (poor to excellent) and accuracy (not accurate-extremely accurate) of translation on a 5-point scale. The translated group reported a higher mean understanding rating (4.5 out of 5) than the English-Only group (4 out of 5). This group also rated the overall accuracy of the translation highly with a mean rating of 4 out of 5.

4. DISCUSSION

The results of this study reflect that there is an increase in comprehension when a non-native English speaker is able to access translated material in an academic setting. There was an 87.5% increase in mean score from the English-only group (2.40) to the translated group (4.50). On the other hand, this gain may be influenced by the light to no cognitive load that our study needed. Due to the shortness of the reading and quiz, students were able to dedicate more mental resources to understanding the syllabus.

4.1 Preferences

The most common preference was from non-native English speakers stating they'd rather learn new things in their native language. We received feedback similar to "I prefer native language for learning new information because it's more concise and clear to me" from 54% of our participants ($n=6$ out of 11). Additionally, students in the translated group self-reported really high perceived understanding scores ($mean= 4.50$). These results may suggest that the translation feature improved information retention, but could also mean that students put more effort into an assignment once they realized it was able to be translated. Regardless, both of those possibilities support the statement that a translation feature would be greatly beneficial to universities country-wide.

4.2 Barriers

Although our quantitative results showed a positive relationship between translated material and comprehension, qualitative feedback emphasized some specific barriers related to the quality of the translations. Some participants noted a few idioms and technical phrases that were translated too literally which "slightly changed their meaning." Additionally, there seemed to be specific instances pointed out by participants of incorrect terminology being used in the translated versions of the syllabus. A specific scenario was the Spanish translation of "failing grade" to "calificacion de suspenso", which to some Spanish-speaking students may read as "suspense" or "thriller" instead of its intended meaning. Despite the few errors in translation, the high overall quiz scores show that there is still a benefit to the ability to translate core content into a students' native language. Future research could focus on eliminating these barriers by curating a domain-specific term translation instead of using the generic translation.

4.3 Limitations

The main limitation of this study is the small sample size ($n=11$), which greatly decreases the generalizability of the findings and the statistical power of the analyses of specific language comparisons. Furthermore, the translated group encompassed a mix of three different languages, which means that the performance differences could be tied to the quality of the machine translation engine rather than the translation concept itself. Our quiz was fairly short to avoid overload, but this is a common occurrence in college-level classes. This might've contributed to the high quiz scores,

since we tested a relatively easy task on college-level students that are used to more challenging work.

5. CONCLUSION AND FUTURE WORK

The findings of this experimental study demonstrate that integrating a translation feature into digital learning interfaces significantly enhances the comprehension of academic materials for international and immigrant students. The language barrier is immediately reduced by allowing easy translation in everyday systems, like MyCourses, and can serve as a powerful tool for achieving higher material retention and educational equity. While our study was restricted by the barriers of time and resources, we think that evolving and continuing this research could really benefit universities globally. Future works should focus on making this a longitudinal study with at least 100-200 participants in various regions of the United States. This would help us determine if the translation benefit also improves overall final course grades, instead of just immediate quiz scores. Furthermore, researching the interface design itself would be useful to explore how to best present the translation feature to maximize comprehension and minimize distractions. In order to provide the most effective translation, a testing machine translation model that knows academic jargon and domain-specific terminology could be developed. This would aid in mitigating the accuracy issues identified in our qualitative feedback.

REFERENCES

- [1] Hajin Lim, Dan Cosley, and Susan R. Fussell. 2018. Beyond Translation: Design and Evaluation of an Emotional and Contextual Knowledge Interface for Foreign Language Social Media Posts. In Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (CHI '18). Association for Computing Machinery, New York, NY, USA, Paper 217, 1–12. <https://doi.org/10.1145/3173574.3173791>
- [2] Van T. T. Dang. 2022. Foreign Language Reading Anxiety and its Correlation with Topic Familiarity. In Proceedings of the 6th International Conference on Education and Multimedia Technology (ICEMT '22). Association for Computing Machinery, New York, NY, USA, 360–365. <https://doi.org/10.1145/3551708.3556209>