

【Reports】

The Creation and Impact of Multimodal Online Tools for English for General Academic Purposes (EGAP) at Tohoku University

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In effort to support students in their ability to acquire the various vocabulary and skills outlined within the *Pathways to Academic English* textbook, a multimodal online tool was created by teachers from the Center for Culture and Language Education, Institute for Excellence in Higher Education at Tohoku University. This report summarizes how and why online multimodal tools were produced, and the effectiveness they have had on the first-year English for General Academic Purposes (EGAP) classes at Tohoku University. Through quantitative analysis of student usage, qualitative surveys, and vocabulary quiz scores, this report shows the initial findings that our multimodal online learning tools have impacted student learning positively in terms of motivation and advancement of EGAP.

1. Introduction

In 2019, a working group inside of the English curriculum reform committee was tasked with creating a unified English curriculum which has been delivered to first-year students at Tohoku University via the *Pathways to Academic English* textbook since 2020. The curriculum requires the memorization of approximately one-thousand vocabulary units (including both single-word and multi-word units) and mastery of nearly a dozen skills across four classes during a single academic year. While the curriculum has positively and consistently impacted English for General Academic Purposes (EGAP), we are constantly striving to increase EGAP acquisition, as measured by the TOEFL ITP® test. Thus, in an effort to further elevate EGAP, innovative and efficient ways to study the materials were needed.

In 2022, we started programming an online multimedia tool which consisted largely of meaning-based flashcards, and the initial code can be found on GitHub (Spring & Takeda, 2022). The tools have

continuously been updated, but we recognized the need for a login system, as without such a system, teachers had no way of monitoring student usage and holding them accountable for studying with the online tools. Thus, we applied for, and received, an educational grant from Tohoku University (the 2022 Grant for the Promotion of Educational Development) and used it to prepare a login system with more advanced tools and motivational devices. We have created both open-source and closed GitHub repositories, and prepared the website for Tohoku University students and teachers, which can be found at <http://www.pathwaystoacademicenglish.com>.

For almost all of the 16 chapters within the *Pathways to Academic English* textbook, relevant practice worksheets along with at least one online multimedia tool per chapter are available. An example of some of the multimodal online tools are shown in Figure 1.

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投稿資格：1

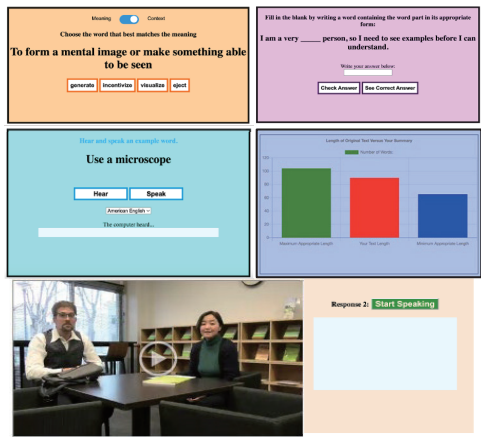


Figure 1 : Example Online Tools

Table 1 : Available Multimodal Tools per Skill

		Online Tools					
Class	Chapter	Work-sheets	Multiple Choice	Fill-in-the-blank	TTS ASR	Audio or Videos	Writing or Speaking Feedback
I-A	Word Parts	●	●	●	●		
	Synonyms	●	●	●	●		
	Skimming & Scanning	●					
	Paraphrasing & Summarizing	●					●
I-B	Note-Taking While Listening	●				●	
	Orally Summarizing from Notes	●			●	●	
	Idiomatic Language	●	●	●	●		
	Interrogatives & Stating Opinions	●			●	●	
II-A	Connotative & Denotative Meanings	●	●				
	Implications & Inferences	●	●				
	Collocations	●	●	●	●		
	Paragraph Writing	●					●
II-B	Indirect Language	●	●		●	●	
	Tone of Voice	●	●			●	
	Fluency & Pronunciation	●			●		●
	Discussion Strategies	●			●		

Some of the tools include time-delayed multiple-choice questions, Text to Speech (TTS) listening and Automatic Speech Recognition (ASR)-based pronunciation practices, writing-based fill-in-the-blank activities, and in some cases interactive videos or personalized feedback to paragraph writing or speaking fluency. Table 1 details the various practices available per chapter.

2. Previous Studies and Background

2.1 Previous effects of the unified Pathways to Academic English curriculum

While the *Pathways to Academic English* curriculum was officially unified and released in 2020, a study by Spring and Okada (2021) found that not all students were properly receiving curriculum instruction. However, they also found that those who did study from the curriculum not only performed higher on the TOEFL ITP® test, they also showed greater increases in their scores from the beginning to the end of the year. In a similar vein, Spring and Sakurai (2023) showed that students who used formative assessments of previously taught curriculum skills and scored higher on these tests exhibited greater gains in EGAP learning. Both of these points seem to underscore the importance of not only imparting the curriculum, but also making it as easy as possible for teachers and students to have access to the tools to teach and learn it.

2.2 Previous studies on online tools

One of the first types of tools that we considered creating was online flashcards. Meaning-based flashcards have long been used to promote students’ memorization of vocabulary (e.g., Nakata, 2011; 2020; Schmitt & Schmitt, 1995) and many studies have suggested that interactions with multiple modes help with retention of new vocabulary learning (e.g., Meyer, 2005; Schmidt, 2000). For example, Laufer (2017) argues that the more details about a word that

a learner focuses on, the more likely they are to remember it. Furthermore, the ‘task-involvement load’ hypothesis (Laufer & Hulstijn, 2001) and works such as Swain (1985) suggest that productive tasks, such as speaking and writing, in vocabulary learning will increase involvement and in turn the likelihood of remembering a word. Because the general body of research encourages interaction with vocabulary in a variety of ways, the multimodal online tools were created. Additionally, a study by Takeda (2023) found that a beta version of our online tools likely played a meaningful role in final test scores. Furthermore, Spring and Takeda (2023) also found that increased usage of the tools generally predicted outcomes on quiz scores, indicating the importance of using these tools.

We also created three tools specifically for writing practice: one for summary writing, one for paraphrasing, and one for paragraph writing. The paraphrasing tool was based on pre-existing worksheets for paraphrasing, as per the *Pathways to Academic English* textbook, but added the advantage of automated feedback. The summary writing tool was created based on the textbook as well, and provides students with feedback about summary length appropriateness and the amount of copying that was used from the source text. The summary writing tool was found to encourage less copying and more length-appropriate texts, which also resulted in better human-rated scores (Spring, forthcoming). The paragraph-writing tool provides three objective measures of complexity and fluency measures (e.g., Lu, 2012; Kyle, 2016) and one of usage of the discourse markers given in the *Pathways to Academic English* textbook that correlate with better rater-scores (Spring, 2023).

Finally, we also created tools that provide speaking opportunities for students, based on local-device Automatic Speech Recognition (ASR) technology. Although this technology is imperfect at guessing

what second language learners are saying (Ahn & Lee, 2016), it is generally correlated with pronunciation ability (Spring, 2020) and has been shown to be a useful tool to encourage second language speaking, and increase pronunciation ability (e.g., Guskaroska, 2020; Spring & Tabuchi, 2022; Wu et al., 2022). We also created video tools to accompany some of these tasks in order to further encourage speaking (Nakamura et al., 2024).

3. Methods

3.1 Online Multimedia Tool Creation Procedure

Due to time constraints and programming-knowledge limitations, the online tools were initially basic HTML, CSS, and simple JavaScript-based flashcards. Originally, in spring of 2022, only two teachers (the tool developers and authors of this report) encouraged their usage in the classroom. The following autumn, after receiving positive feedback from students (Takeda, 2023) the tools were further developed in depth and width, and opened up to all full and part-time English instructors at Tohoku University.

April of 2023 brought about more online tools and a new login system for students and teachers, allowing students the potential to receive digital awards for their study efforts and perhaps a spot on the leaderboards. Example awards and a leaderboard are shown in Figure 2. Teachers could also track their students’ usage, allowing them to effectively assign the online tools as homework.



Figure 2 : Example Awards and Leaderboard

3.2 Participants

As of the writing of this report, TOEFL ITP® scores are not yet available for the 2023 academic year and thus exact comparisons with previous years are not yet possible. However, while greater engagement and interactions with the curriculum materials would suggest improvement, the authors focused on a sample of 458 first-year students and how the multitudes of their interactions with multimodal online tools affected formative assessment scores.

The participants were instructed by one of the authors who both utilized the textbook, materials, homework assignments, and quizzes from the unified *Pathways to Academic English* curriculum. Over the course of the spring 2023 semester, a total of 236 students from class I-A and 222 students from class I-B made use of the online tools and took various vocabulary quizzes. Then, at the end of the semester, 458 students reported on here gave their informed consent to be included in this study and participated in a survey about opinions regarding the online tools. They were given the option to opt out without any repercussions. The data used in this report was taken as part of a larger study, approved by the internal review board of the Institute for Excellence in Higher Education (approval number k00402).

3.3 Student Usage and Reported Helpfulness

During the spring semester of 2023, students in our study were required to study with the online multimedia tools as homework (and the teachers checked their practice via the ‘student usage tracker’). Students had the ability to choose between the following multimodal tools: multiple choice flashcards (WC), fill-in-the-blank writing (W), and listening (TTS) and speaking (ASR). Table 2 shows the range of attempts student made.

Table 2 : Range of Student Attempts for Each Vocabulary Type and Usage Across Modes

	MC	W	TTS	ASR
Word Parts	6 - 3434	0 - 1182	0 - 774	0 - 768
Synonyms	0 - 2317	0 - 1319	0 - 639	0 - 317
Phrasal Verbs	0 - 342	0 - 305	0 - 496	0 - 496
Idiomatic Expressions	0 - 1142	0 - 1033	0 - 370	0 - 388
Overall Attempts				
Paraphrasing	0 - 242			
Summarizing	0 - 54			
Orally Summarizing	0 - 34			
Interrogatives & Stating Opinions	0 - 51			

To determine how *helpful* students considered the online multimodal tools to be in their study efforts, students were asked to answer a survey of 10 questions, six of which were based on a 5-point Likert scale. Takeda (2022) had previously found that over 75% of students last year had deemed the tools to be *helpful* or *very helpful*, but the results were even more positive this year. Student feedback over two years is shown in Figure 3. While last year word parts and synonyms were more highly regarded than phrasal verbs and idiomatic expressions, 2023 showed more even *helpfulness* of the tools.

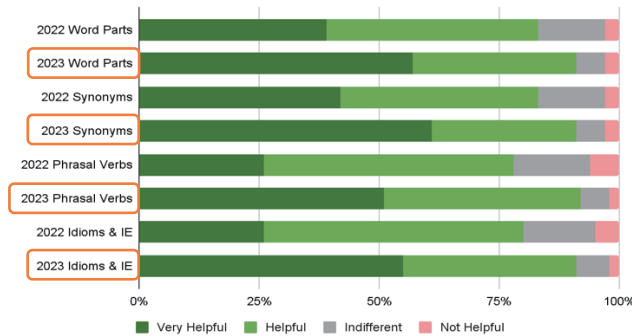


Figure 3: Student Reported “Helpfulness” Over Two Years

Beyond the tools having been further developed in 2023 than in 2022, the authors also believe that the additions of digital awards and potential to earn a place on leaderboards may have increased students' motivation to use the online tools, which may have ultimately led to students claiming the tools to be more helpful. In fact, a correlation analysis between students' reported *helpfulness* of the online tools and their actual usage of the tools suggests that students who found the awards and leaderboards motivating, indeed did make greater attempts, as shown in Table 3.

Table 3 : Correlation of Attempts and Motivations

I-A Class					
Motivation: Leaderboard	.67				
Word Parts Helpful	.15	.09			
Synonyms Helpful	.12	.07	.87		
Word Parts Attempts	.24	.28	.07	.02	
Synonyms Attempts	.24	.19	.18	.20	.58
	Motivation: Medals	Motivation: Leaderboard	Word Parts Helpful	Synonyms Helpful	Word Parts Attempts
I-B Class					
	Motivation: Medals	Motivation: Leaderboard	Phrasal Verbs Helpful	Idiomatic Expressions Helpful	Phrasal Verbs Attempts
Motivation: Leaderboard	.69				
Phrasal Verbs Helpful	.31	.20			
Idiomatic Expressions Helpful	.31	.21	.91		
Phrasal Verbs Attempts	.31	.26	.11	.13	
Idiomatic Expressions Attempts	.38	.27	.14	.17	.83

4. Results

4.1 Student Feedback

Some students also provided comments about the online tools. Many stated that the tools were helpful for memorization, and others suggested improvements such as less-robotic TTS voice selections or browser accessibility troubles. To increase student anonymity, English translations of some representative examples of student feedback are shown in Table 4.

Table 4 : Translated Student Feedback

It was helpful because I could pinpoint or randomize words I wanted to learn.
With just the textbook, I wouldn't know where to start studying and I wouldn't be able to tell if I had mastered anything. With the quiz format of the online tools, I was able to study more easily.
I was grateful for being able to study with the online flashcards in my free time. I hope this continues.
I felt that it was an efficient learning tool, but I regret that I didn't have many opportunities to use it due to my laziness as I was self-studying.
I would like to see improved voice recognition. It worked fine on my computer, but sometimes it didn't work well on my smartphone browser.
Because the vocabulary was used in an example sentence, it was easier to fully understand the word (more effectively than flashcards with a target word only). Especially while practicing writing, there were many situations where I had to be careful about tenses, or plurality so I felt it was good practice.
I really appreciated that I was able to systematically learn Phrasal Verbs and Idiomatic Expressions through example sentences. All the way through high school, I didn't have many opportunities to learn English through speaking, so I think I was able to learn some correct pronunciation by using the online flashcards to pronounce things along with the audio.
You can easily practice it over and over again, so before you know it, you've mastered the expression.
It was tough when I had trouble understanding even simple words using "speaking", but I enjoyed learning every time. I was happy when I was able to get on the leaderboard and win medals.

4.2 Impact of Formative Assessment Before and After Online Tools

One additional indication of the usefulness of the online tools comes in comparing the impact of formative assessment on students' EGAP learning. Formative assessments are generally thought of as informal assessments that are low-stakes, meaning that they do not impact grades directly, and instead help to inform both teachers and students of their progress in order to identify problem areas for individual learners so that they can work on those areas or receive assistance as necessary (e.g., Black & Wiliam, 2009; Gardner, 2012). Spring and Sakurai (2023) reported on the results of students who took formative assessments of the first semester core skills at Tohoku University and compared them to those who did not, finding that there was a significant difference in increased TOEFL ITP® scores for students who took the assessments in 2021. The results indicated that many of the students who took the assessments likely reviewed their problematic areas, which helped to increase their learning, as intended.

In 2021, when there were no online tools, students were simply asked to review and use their textbooks and any available resources (Spring & Sakurai, 2023). However, in the 2022 school year, when the assessments were recreated, students were provided links to the preexisting online tools and asked to practice using them. The impact of these tools becomes more apparent when we compare the improvement gap in formative assessment takers

and non-takers over these years, as presented in Figure 4. These results suggest that the direct links to online tools provided a much easier way for students to review their problematic areas, and increased the effectiveness of the formative assessments in general.

5. Discussion, Conclusion, and Future Work

Overall, the multimodal tools, as far as we have been able to study them until now, have encouraged greater overall usage and interactions with the *Pathways to Academic English* unified curriculum and materials, and seem to be having an impact on the successful improvement of EGAP ability. The digital awards and teachers' ability to check actual student usage have proved motivating and helpful to students.

While it is unknown at the moment, the authors are interested in determining whether students' interactions with the multimodal online tools have an effect on TOEFL ITP® scores. Additionally, we hope to add new features to the online tools in the future, specifically an intelligent tutor which will take the form of an avatar who will guide and motivate students to use each of the different modes.

Funding Acknowledgements

The online multimodal tools mentioned in this manuscript were created with support by an educational grant from Tohoku University (the 2022 Grant for the Promotion of Educational Development).

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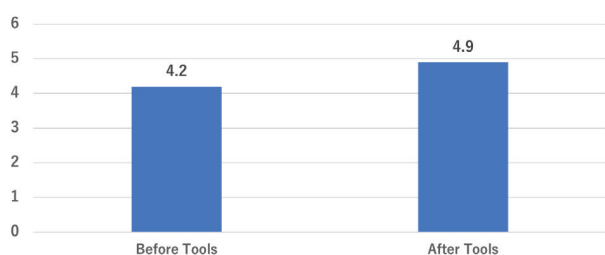


Figure 4 : Comparison of Improvement Gaps in Formative Assessment Takers and Non-Takers

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