

The Application of Text-to-Speech Technology in Language Learning

A Systematic Review

Ashanti Widyana*, Mohammad Iqbal Jerusalem, Budi Yumechas

Universitas Pendidikan Indonesia

*Corresponding author. Email: ashantiwdn@upi.edu

ABSTRACT

Technology has improved temporarily from time to time. There are a lot of technologies that had been developed to enhance language learning, and one of them is text-to-speech technology. Text-to-speech technology is a form of system that can convert phoneme to audio. It has provided an impact in language learning since it was developed. This article presents how the application of text-to-speech technology is used in language learning, including the negative and positive side of text-to-speech technology in language learning. It reports on the results of a systematic review of articles that specifically examine the use of text-to-speech technology in language learning. The articles were published between 2012 and 2022 and collected from several databases, including Google Scholar, Elsevier, SAGE, Springer, ERIC, IEEE, and Taylor & Francis. The articles were then reviewed and selected using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) approach. The analysis results of 20 selected articles revealed that the use of text-to-speech assisted the process of knowledge transfer. Text-to-speech technology has also played a practical role in language learning, especially in improving students' language skills. The review also revealed that text-to-speech technology lacks in intonation, eye-contact, and real-time class interaction. But overall, despite that it has a slight negative impact, text-to-speech technology can be a breakthrough to support language learning.

Keywords: *Language learning, Systematic literature review, Text-to-speech technology.*

1. INTRODUCTION

Technology has been developing rapidly from time to time. With the continuous evolution of technology, it is easier for a lot of people to access various information. Furthermore, technology facilitates human work in various aspects of life. During the pandemic Covid-19, the use of technology has increased, and several business sectors have triumphed during the Covid-19 pandemic, such as TV and film streaming services as well as online retail, and mobile phones (Hardach, 2021). It is reported that in Indonesia, mobile phone users have reached 345.3 million, of which around 98.2% are smartphone users (Putri, 2021).

Technology has also helped learners around the world to make them easier to learn foreign languages. Foreign language learning has been growing during the implementation of lockdown in the Covid-19 pandemic. Blanco (2020) has reported that there is a significant increase in new learners right as each country announced its lockdown. In China, it is reported that the country

experienced the first wave of new learners when they locked down in February 2020 and it grew more than 300% even weeks later, in April 2020.

Technology-based language learning may vary from its form, like applications, software, hardware, game-oriented and website-oriented applications. One of the most used learning applications is Google Translate. Ramdhani (2021) found that Google Translate can support students in learning English effectively. Google Translate has a text-to-speech (TTS) technology in it. Cardoso (2022) figured out that this technology effectively enhances students' vocabulary learning.

Oumaima, Abdelouafi and Meryem (2018) discovered that in Arabic language, text-to-speech is possible to correct phonetical errors of students' spelling. A study conducted by Suro and Ono (2016) point out that Japanese EFL learners with lower proficiency are suggested to depend on text-to-speech for them to understand learning materials. But in other side, Chiang (2019) revealed a comparison between teacher-led

dictation and text-to-speech dictation for vocabulary learning. It showed that the students seemed to rely on the classroom English teacher as their model for pronunciation because the TTS technology is sometimes sounds unnatural.

The previous research shows the fact that TTS technology has both weaknesses and strengths on language learning. Those problems lead us to conduct further research about it. We would like to find out the worthiness of text-to-speech to be applied in the learning process as a learning media. This study reviews articles from 2012 to 2022 about text-to-speech in language learning using a systematic review method. The target of this study is to reveal the potential, possibility, and probability for text-to-speech to be applied in language learning widely. What text-to-speech technology is and how it is applied in language learning are also discussed.

2. LITERATURE REVIEW

2.1. *Technology in Language Learning*

Technology is the particular-practical application of knowledge which contains a manner of accomplishing a task especially using technical processes, methods, or knowledge (Isman, 2012). In the context of language learning, technology promotes learners' autonomy and helps them feel more confident and increases learners' motivation to effectively learn a foreign language (Ahmadi, 2018).

In this era, technology is always accompanied by information as information technology (IT). The development of information technology is used in all aspects, including education. Information technology is established to renew the way of learning. Kadir and Triwahyuni (2013) suggest that information technology can also give birth to new features in the world of education. Multimedia-based teaching systems can present subject matter that is more interesting, non-monotonous, and facilitates delivery. Students can study certain materials independently by using multimedia-based programs.

2.2. *Artificial Intelligence in Language Learning*

Artificial intelligence is a branch of computer science (CS), which is the scientific study of what problems can be solved, what tasks can be accomplished, and what features of the world can be understood computationally (Rapaport, 2020). It provides algorithms to show how this can be done efficiently, practically, physically, and ethically.

An artificial intelligence logic-based approach tries to attach logical structures to sentences showing their meaning. Like theoretical linguistics, this produces a little value at any large scale. Artificial intelligence in

language learning takes part in machine translating. Reasonably good quality of machine translating is now available free on the web in dozens of languages and can certainly be counted as an AI success (Wilks, 2019).

2.3. *Text-to-Speech in Language Learning*

Text-to-speech is a technology that can be defined as a system that converts text into speech. Trivedi et al. (2018) defines that text-to-speech is a process in which input text is first analyzed, then processed and understood, and then the text is converted to digital audio and then spoken. Sasirekha and Chandra (2012) describe that text to speech synthesizer is a computer-based system that can read text aloud automatically.

According to Pramadewi (in Bachtiar, 2013), text-to-speech (TTS) is an application in the field of language technology, which can convert the text in the format of a language into speech according to the language used. Ren et al. (2019) defines text-to-speech as a system that aims to synthesize natural and intelligible speech given text. Ifeanyi, Ikenna and Izunna (2014) describes that text-to-speech converts written input to spoken output by generating synthetic speech.

In language learning context, perception and comprehension of foreign speech is also extremely important. TTS can be applied for Computer-Assisted Language Learning (CALL). TTS technology can be used for methodological purposes, for example, to create exercises that suppose a dictation in a foreign language. These exercises are necessary for training listening skills (Krasnova & Bulgakova, 2014).

3. METHOD

The method that is used for this study is PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis). PRISMA contains two points: systematic review and meta-analysis. A systematic review attempts to collate all relevant evidence that fits pre-specified eligibility criteria to answer a specific research question. It uses explicit, systematic methods to minimize bias in the identification, selection, synthesis, and summary of studies. Meta-analysis is the use of statistical techniques to combine and summarize the results of multiple studies. By combining data from several studies, meta-analyses can provide more precise estimates (Moher et al., 2015).

Corresponded to the guide of PRISMA steps, we divided our systematic review into three steps: (1) collecting, (2) selecting, and (3) analyzing. On behalf of these guide, we conduct the research systematically.

3.1. *Article Collection*

In this step, we collected several articles with related keywords. They are 'technology', 'text-to-speech', 'read

aloud', and 'language learning' in bilingual, English and Indonesian.

We determined three main criteria for collecting articles. The first criterion is the article was published in the last 10 years (2012-2022). Within that range, the content of the article would be still relevant. The second criterion is that we excluded articles that did not address the application or use of text-to-speech technology in language learning. The third criterion is that we excluded articles that address TTS technology, but it is focused on the TTS systems and its algorithm without figuring out the technology in language learning.

Based on the article search results, we found 85 articles from eight databases: Google Scholar (69 articles), Elsevier (2 articles), SAGE (3 articles), Springer (1 article), ERIC (5 articles), and Taylor & Francis (2 articles), ICLR (1 article), IEEE (2 articles). Furthermore, the articles are filtered for checking duplicate articles with EndNote. The results of this examination show one duplicate article and finally left to 84 articles.

3.2. Article Selection

In this step, we selected and organized the 84 found article by selecting appropriate and relevant literature. After reading the title and abstract, 39 articles were eliminated because the title did not match the research objectives, and the 25 abstracts were irrelevant. This leaving 20 articles to be analyzed from seven databases: Google Scholar (6 articles), Elsevier (2 articles), SAGE (2 articles), Springer (1 article), ERIC (6 articles), IEEE (2 articles), and Taylor & Francis (1 article).

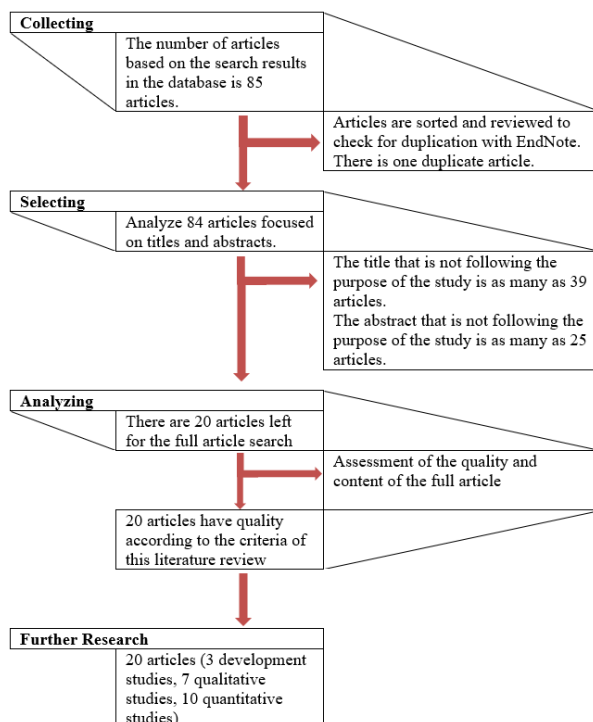


Figure 1 Analyzing article with PRISMA steps.

3.3. Data Analysis

Within 20 articles, there are 3 development studies, 7 qualitative studies, and 10 quantitative studies. The whole process can be seen in Figure 1.

Figure 1 presents the analyzing step of the article was carried out in three stages. First stage is reading the full article and understanding the contents. Second stage is extracting and summarizing them in table form. Third stage is analyzing the similarities and differences in each article's content and concludes the findings in the form of categories. Complete findings are presented in the findings and discussion section.

4. FINDINGS AND DISCUSSION

Based on the results of the analysis of the 20 articles, we found that the application of text-to-speech technology in language learning includes: (1) language learning applications with text-to-speech technology, (2) language skill improvement with text-to-speech technology, (3) text-to-speech for students with impairments or disabilities, and (4) text-to-speech as the language learning media. We also found the advantages and disadvantages of text-to-speech in language learning. The grouping of analyzed article can be seen in Table 1.

Table 1 presents the grouped analyzed article. The results of articles analysis regarding the application of text-to-speech in language learning are described below:

4.1. Text-to-Speech Usage in Language Learning

4.1.1. Language Learning Applications with Text-to-Speech Technology

Text-to-speech can be used in learning English with the form of application. Yudhistiro and Silalahi (2021) found that text-to-speech application can be used as an interesting learning media for students at SD YBPK Ngaglik Malang. It increased students' enthusiasm for learning English. Manu and Masan (2020) also figured out that the text-to-speech application to improve learning English for students with disabilities. It is implemented using a text-to-speech solution and several additional tools as supporting media. In the context of English dictionary application with TTS technology, Sari (2018) also pointed out that text-to-speech can be used in learning English tenses and vocabulary.

Text-to-speech can also be used in learning local language. Pramadewi, Kesiman, and Darmawiguna (2013) discovered that text-to-speech applications can be a new media for Balinese language learning. This is also a way to maintain Indonesia's culture.

Table 1. Analyzed articles

No.	Author	Year	Article's Name	Source	Group
1	Manu & Masan	2020	Text-to-Speech Application to Improve English Language Learning for Disabled Students	Google Scholar	Impaired Students Learning
2	Nugroho, Kharisma, & Wardhono	2019	Developing Kanji Learning Application using MLKit Text Recognition, Text-to-Speech and Kanji Alive API (Case Studies: Kun-Yomi for JLPT N5-N3)	Google Scholar	Application
3	Pramadewi, Kesiman, & Darmawiguna	2013	Developing Text-to-Speech Application for Balinese Language	Google Scholar	Application
4	Sari	2018	English Dictionary Application with Android-based Text-to-Speech Technology	Google Scholar	Application
5	Yudhistiro & Silalahi	2021	Improving Vocabulary Pronunciation Skill for English Language Learning with Text-to-Speech Technology and Speech Recognition in YPBK Malang Elementary School	Google Scholar	Application
6	Huang & Liao	2015	A Study of Text-to-Speech (TTS) in Children's English Learning.	ERIC	Language Learning
7	Guclu & Sinan	2015	Using text to speech software in teaching Turkish for foreigners: The effects of text to speech software on reading and comprehension abilities of African students.	Google Scholar	Application
8	Stodden et al.	2012	Use of text-to-speech software to improve reading skills of high school struggling readers.	Elsevier	Application
9	Moon	2012	Web-based text-to-speech technologies in foreign language learning: opportunities and challenges	Springer	Language Learning
10	Eksi & Yesilcinar	2016	An Investigation of the Effectiveness of Online Text-to-Speech Tools in Improving EFL Teacher Trainees' Pronunciation.	ERIC	Teacher Training
11	Wood, Tighe, & Wagner	2018	Does use of text-to-speech and related read-aloud tools improve reading comprehension for students with reading disabilities? A meta-analysis." by Wood, Tighe, & Wagner (2018).	SAGE	Impaired Students Learning
12	Young et al	2019	The effects of text-to-speech on reading outcomes for secondary students with learning disabilities	SAGE	Impaired Students Learning
13	Bone & Bouck	2017	Accessible text-to-speech options for students who struggle with reading	Taylor & Francis	Impaired Students Learning
14	Parr	2012	The Future of Text-to-Speech Technology: How Long before it's Just One More Thing we do When Teaching Reading?	Elsevier	Language Learning
15	Amin	2022	Using Repeated Reading and Listening While Reading via Text to Speech APPs. in Developing Fluency and Comprehension	ERIC	Language Skill Improvement
16	Van Lieshout & Cardoso	2022	Google Translate as a Tool for Self-Directed Language Learning	ERIC	Language Learning
17	Cardoso	2022	Learning L2 pronunciation with a text- to-speech synthesizer	ERIC	Language Learning
18	Chiang	2019	A Comparison between Teacher-Led and Online Text-to-Speech Dictation for Students' Vocabulary Performance	ERIC	Language Skill Improvement
19	Oumaima, Abdelouafi, & Meryem (2018)	2018	Text-to-speech technology for Arabic language learners.	IEEE	Language Learning
20	Suro & Ono	2016	Japanese EFL learners' uses of Text-to- Speech technology and their learning behaviors	IEEE	Language Learning

Nugroho, Kharisma and Wardhono (2019) revealed that text-to-speech is very important to have a high influence on solving problems, especially difficulties in learning Kanji in Japanese. Text-to-speech makes it easy to understand Kanji learning. Text-to-speech increases effectiveness in learning Kanji.

4.1.2. Language Skill Improvement with Text-to-Speech Technology

Text-to-speech can improve a lot of language skills. In the context of pronunciation improvement, Chiang (2019) discovered that students with TTS dictation test

compared to TLD (Teacher-led Dictation) test in dictating vocabulary performed better. Suro and Ono (2016) found that in pronouncing a text in a passage, students that use TTS, compared to students that do not use TTS, improved their performance. Pramadewi, Kesiman, and Darmawiguna (2013) pointed out that the voice that is the output of text-to-speech will make it easier for someone to learn the pronunciation of a word in a particular language because every language has the uniqueness and rules of pronunciation of words that are different from other languages.

Not only for improving students' language skills, TTS is also used to train teachers' language skills. Ekşi and Yeşilçınar (2016) found that text-to-speech can be used to train language teacher trainees. The study conducted showed a result that language teacher trainees' fluency, pronunciation, and the total scores in the post-test achievement, compared to pre-test, were higher. Text-to-speech improves pronunciation of sounds, word stress, and basic intonation patterns. Unlike online dictionaries, text-to-speech websites allowed the trainees to listen to longer texts and hear the flow of speech, which they appreciated.

In the context of reading skill, Amin (2022) discovered that TTS can help in improving students' reading fluency and comprehension. It also motivated the students through a positive and encouraging learning environment.

4.1.3. Assisting Impaired Students with Text-to-Speech Technology

Students with impairment have a lot of problem in learning language. Text-to-speech is designed to assist them on the learning process. Manu and Masan (2020) pointed out that text-to-speech for students with disabilities carried a greater access to learn language for those who have learning difficulties or who are blind.

Bone and Bouck (2016) found that text-to-speech software may help students feel less fatigued and have more memory space to think about the actual content they are reading. Students with reading disabilities feel more comfortable working independently on a reading task and can complete it in an appropriate time frame without teacher support. Wood, Moxley, Tighe and Wagner (2018) and Young, Courtad, Douglas and Chung (2019) concluded a same result that text-to-speech presentation positively increases reading comprehension for individuals with reading disabilities.

Pramadewi, Kesiman and Darmawiguna (2013) pointed out that text-to-speech software can be applied in various fields, especially since it will be very useful for people who have disorders. Stodden, Roberts, Takahashi, Park and Stodden (2012) indicated that text-to-speech software improves heard accuracy and correct pronunciations of most words of struggling students. The

speech synthesis of the software reduced typical students' substitution errors and decoding errors.

4.1.4. Language Learning Media with Text-to-Speech Technology

Language learning needs a media to improve the process effectively, so that teachers need a tool that could facilitate learning. Yudhistiro and Silalahi (2021) pointed out that text-to-speech can be used as a learning medium that helps teachers in activities of language learning. Sari (2018) also indicated that text-to-speech is useful as a language learning medium for interactive English learning.

Van Lieshout and Cardoso (2022) found that TTS can be used as a pedagogical tool for self-directed L2 learning, accompanied with Automatic Speech Recognition (ASR) in Google Translate. Cardoso (2022) elaborated that TTS as an out-of-class pedagogical tool could increase in-class time so that teachers and students could focus on other important tasks such as providing feedback and engaging in real-life communicative activities.

Text-to-speech can also be used as a media to assist a specific learning method. Oumaima, Abdelouafi and Meryem (2018) discovered that TTS could be implemented in the process of dictation exercise. TTS develops efficacy in language learning by exploring the effects of aural feedback on pupils' performance.

4.2. Text-to-Speech Advantages in Language Learning

We found several advantages of the application of text-to-speech. Manu and Masan (2020) discovered that a lot of text-to-speech advantages. There are at least nine advantages: 1) help in reading, listening, and literacy in the modern era, 2) listen to learn a digital scenario, 3) enhance the concentration of students to a speech, 4) reduce the drain on teachers in terms of explaining the material, 5) help in learning foreign languages and its pronunciation, 6) bring up a strong strategy in listening to books and other texts, 7) provide time for students to revise their writing, 8) give an opportunities for students to process the material individually, 9) improve students' understanding in the learning process.

Parr (2012) indicated that text-to-speech can facilitate and extend reading strategies and processes in the classroom (e.g., word solving, expression, fluency, response). Text-to-speech is responsible for contributing to a student's self-confidence and self-efficacy as a reader. In addition, text-to-speech enhances students' spelling ability and self-study motivation (Huang & Liao, 2015).

4.3. Text-to-Speech Disadvantages in Language Learning

Besides the advantages, we found that text-to-speech has also slight disadvantages in language learning. In English language learning, Moon (2012) found that text-to-speech still has its limitations in terms of naturalness, pleasantness, and expressiveness. Those disadvantages make learners may misinterpret some words pronounced differently. Furthermore, voices sounding artificial may cause learners to lose interest in using text-to-speech for learning English.

In Turkish language learning, Guclu and Igit (2015) emphasized that text-to-speech software is not capable of delivering Turkish text yet. Lack of intonation, eye contact, and real-time class interaction can be named as major drawbacks of text-to-speech software. These drawbacks have made the students lose concentration since the software was missing the spirit of the teacher and was incapable of giving the exact intonation and pronunciation of the words so that students can understand the text clearly.

In the context of the learning process, Parr (2012) pointed out that text-to-speech runs the risk of stigmatizing students who are perceived to be different, who are privileged in the sense that they have a computer, or who are accused of cheating. Chiang (2019) found that students' perception is different with the improvement of their performance on learning. They seemed to strongly agree with the statement "The teacher is the role model for pronunciation in the classroom" because TTS technology is sometimes still very mechanical and does not sound emotional.

Like other technologies, text-to-speech has both advantages and disadvantages. The articles that we found above showed up that text-to-speech is potential to be used on language learning process despite of the disadvantages. Text-to-speech is indeed possible to enhance language learning with a little adjustment on the process. So that, text-to-speech could be applied properly and effectively.

5. CONCLUSION

Based on the findings, it can be concluded that the use of text-to-speech in language learning can support language learning. It improves students' understanding of learning the second languages. Text-to-speech is a technology that becomes a medium for communication to facilitate language learning. Text-to-speech also enhances learning effectiveness and student participation rate. On the other hand, text-to-speech has also slight disadvantages, such as the lack of naturalness, pleasantness, expressiveness, intonation, eye contact, and real-time class interaction. In addition, text-to-speech has

a risk of stigmatizing students who are perceived to be different as students with disabilities.

This study has limitations in analyzing articles that discuss the connection between text-to-speech technology in language learning with students' behavior. Thus, further research should focus more on analyzing the connection on text-to-speech with other aspect. In addition, it would be good if the future research is done directly by implementing text-to-speech in the learning process with certain instruments. This study is also limited in examining text-to-speech in language learning process of normal students. Further research should more focus on one aspect either the learning process of normal students or the learning process of students with disabilities in order to obtain a specific result.

ACKNOWLEDGMENTS

The authors would like to thank Universitas Pendidikan Indonesia for providing a chance for us in international research grants in 2022.

REFERENCES

- Ahmadi, M. R. (2018). The use of technology in English language learning: A literature review. *International Journal of Research in English Education*, 3(2), 115-125.
- Amin, E. A. R. (2022). Using repeated-reading and listening-while-reading via text-to-speech apps in developing fluency and comprehension. *World Journal of English Language*, 12(1).
- Bachtiar, M,R & Yulianto, H . (2017). Rancang bangun aplikasi text-to-speech sebagai pembelajaran bahasa inggris untuk tuna wicara. Universitas Stikubank.
- Blanco, C. (2020). *2020 Duolingo Language Report: Global Overview* [Duolingo]. Retrieved from <https://blog.duolingo.com/global-language-report-2020/>
- Bone, E. K., & Bouck, E. C. (2017). Accessible text-to-speech options for students who struggle with reading. *Preventing School Failure: Alternative Education for Children and Youth*, 61(1), 48-55.
- Chiang, H. H. (2019). A Comparison between Teacher-Led and Online Text-to-Speech Dictation for Students' Vocabulary Performance. *English Language Teaching*, 12(3), 77-93.
- Eksi, G. Y., & Yesilcinar, S. (2016). An Investigation of the Effectiveness of Online Text-to-Speech Tools in Improving EFL Teacher Trainees' Pronunciation. *English language teaching*, 9(2), 205-214.
- Guclu, B., & Igit, S. (2015). Using text to speech software in teaching Turkish for foreigners: The

- effects of text to speech software on reading and comprehension abilities of African students. *Journal in Humanities*, 4(2), 31-33.
- Hardach S. (2021). *Covid-19: Pelajar bahasa asing meningkat saat pandemi, mengapa?* [BBC Future]. Retrieved from <https://www.bbc.com/indonesia/>
- Huang, Y. C., & Liao, L. C. (2015). A Study of Text-to-Speech (TTS) in Children's English Learning. *Teaching English with Technology*, 15(1), 14-30.
- Ifeanyi, N., Ikenna, O., & Izunna, O. (2014). Text-To-Speech Synthesis (TTS). *International Journal of Research in Information Technology*, 2(5), 154-156.
- Isman, A. (2012). Technology and technique: An educational perspective. *Turkish Online Journal of Educational Technology-TOJET*, 11(2), 207-213.
- Kadir, A., & Triwahyuni, T. C. (2013). Pengantar teknologi informasi edisi revisi. *Yogyakarta: Penerbit Andi*.
- Krasnova, E., & Bulgakova, E. (2014). The use of speech technology in computer assisted language learning systems. *International Conference on Speech and Computer* (pp. 459-466). Springer, Cham.
- Manu, G. A., & Masan, P. L. (2020). Aplikasi text to speech untuk meningkatkan pembelajaran bahasa Inggris bagi siswa disabilitas. *Jurnal Pendidikan Teknologi Informasi (JUKANTI)*, 3(2), 17-26.
- Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., ... & Stewart, L. A. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Systematic Reviews Journal*, 4(1), 1-9.
- Moon, D. (2012). Web-based text-to-speech technologies in foreign language learning: opportunities and challenges. *Computer applications for database, education, and ubiquitous computing*, 120-125.
- Nugroho, F. M., Kharisma, A. P., & Wardhono, W. S. (2019). Pengembangan aplikasi pembelajaran Kanji menggunakan MLKit Text Recognition, Text-to-Speech dan Kanji Alive API (Studi Kasus: Kun-Yomi pada JLPT N5-N3). *Jurnal Pengembangan Teknologi Informasi dan Ilmu Komputer*.
- Oumaima, Z., Abdelouafi, M., & Meryem, E.H. (2018). Text-to-speech technology for Arabic language learners. *2018 IEEE 5th International Congress on Information Science and Technology (CiSt)* (pp. 432-436). IEEE.
- Parr, M. (2012). The Future of Text-to-Speech Technology: How Long before it's Just One More Thing we do When Teaching Reading?. *Procedia-Social and Behavioral Sciences*, 69, 1420-1429.
- Pramadewi, P. M. M., Kesiman, M. W. A., & Darmawiguna, I. G. M. (2013). Pengembangan aplikasi text to speech untuk bahasa Bali. *KARMAPATI (Kumpulan Artikel Mahasiswa Pendidikan Teknik Informatika)*, 2(5), 628-637.
- Putri N, J. (2021). *Perkembangan Teknologi Semakin Pesat* [Kompasiana]. Retrieved from <https://www.kompasiana.com/>
- Ramdhani, A. D. (2021). Penggunaan google translate dalam menunjang pembelajaran bahasa inggris siswa.
- Rapaport, W. J. (2020). What is artificial intelligence?. *Journal of Artificial General Intelligence*, 11(2), 52-56.
- Ren, Y., Ruan, Y., Tan, X., Qin, T., Zhao, S., Zhao, Z., & Liu, T. Y. (2019). FastSpeech: Fast, robust and controllable text to speech. *Advances in Neural Information Processing Systems*, 32.
- Sari, I. (2018). Aplikasi kamus bahasa Inggris dilengkapi dengan fasilitas teknologi text to speech berbasis android. *Jurnal Teknologi Dan Ilmu Komputer Prima (JUTIKOMP)*, 1(1), 28-30.
- Sasirekha, D., & Chandra, E. (2012). Text to speech: a simple tutorial. *International Journal of Soft Computing and Engineering (IJSCE)*, 2(1), 275-278.
- Stodden, R. A., Roberts, K. D., Takahashi, K., Park, H. J., & Stodden, N. J. (2012). Use of text-to-speech software to improve reading skills of high school struggling readers. *Procedia Computer Science*, 14, 359-362.
- Suro, F., & Ono, Y. (2016). Japanese EFL learners' uses of Text-to-Speech technology and their learning behaviors: A pilot study. *2016 5th IIAI International Congress on Advanced Applied Informatics (IIAI-AAI)* (pp. 296-301). IEEE.
- Trivedi, A., Pant, N., Shah, P., Sonik, S., & Agrawal, S. (2018). Speech to text and text to speech recognition systems-Areview. *IOSR J. Comput. Eng.*, 20(2), 36-43.
- Van Lieshout, C., & Cardoso, W. (2022). Google Translate as a tool for self-directed language learning. *Language Learning & Technology*, 26(1), 1-19.
- Wilks, Y. (2019). Artificial Intelligence: Modern Magic or Dangerous Future?. *Hot Science*. Icon Books.
- Wood, S. G., Moxley, J. H., Tighe, E. L., & Wagner, R. K. (2018). Does use of text-to-speech and related

- read-aloud tools improve reading comprehension for students with reading disabilities? A meta-analysis. *Journal of learning disabilities*, 51(1), 73-84.
- Young, M. C., Courtad, C. A., Douglas, K. H., & Chung, Y. C. (2019). The effects of text-to-speech on reading outcomes for secondary students with learning disabilities. *Journal of Special Education Technology*, 34(2), 80-91.
- Yudhistiro, K., & Silalahi, E. B. (2021). Peningkatan kemampuan pronunciation vocabulary untuk pembelajaran bahasa Inggris dengan teknologi text-to-speech dan speech recognition di Sekolah Dasar YPBK Malang. *JMM-Jurnal Masyarakat Merdeka*, 4(1).

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

