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# Empowering language learners: Innovations in CEFR-based language learning applications

Ahmad Zaki Amiruddin[1*], Mohammad Taufiq Abdul Ghani[2], Wan Ab Aziz Wan Daud[1], Nur Hafezah Hussein[1], Nur Hazimah Mat Yamin[1], Yasmin See Abdullah[3]
[1]Faculty of Language Studies and Human Development, Universiti Malaysia Kelantan (UMK), 16300 Bachok, Kelantan, Malaysia; ahmadzaki@umk.edu.my (A.Z.A.); abaziz.wd@umk.edu.my (W.A.A.W.D.); nhafezah@umk.edu.my (N.H.H.); hazimah.my@umk.edu.my (N.H.M.Y.).
[2]Faculty of Languages and Communication, Universiti Pendidikan Sultan Idris (UPSI), 35900 Tanjung Malim, Perak, Malaysia; taufiq@fbk.upsi.edu.my (M.T.A.G.).
[3]Academy of Language Studies, Universiti Teknologi MARA (UiTM) Cawangan Kelantan, 18500 Machang, Kelantan, Malaysia; yasminsee@uitm.edu.my (Y.S.A.).

**Abstract:** Language acquisition is crucial for fostering global relationships and promoting communication understanding in an increasingly globalized society. Technology has changed language learning, and the CEFR standardizes language proficiency evaluation. This article examines the need for CEFR-technology integration in language learning applications. The key difficulty is integrating CEFR-based frameworks with educational technology to produce effective language learning applications. This integration addresses varied learner competency levels and improves language acquisition. This study used a quantitative survey approach to examine CEFR-technology integration in language acquisition. Malaysian higher education students were recruited as the sample for this study. A structured questionnaire was the main data collection tool. This questionnaire used closed-ended questions to collect quantitative data on students' CEFR knowledge, language learning technology use, and CEFR-based application perceptions. Simple random sampling ensured a representative sample by giving each student an equal chance. Descriptive statistics were used to summarize the findings and assess the efficacy and use of the CEFR-based language learning tool. The results indicate that students were adept in basic technology skills but showed inconsistency in graphic design and multimedia editing. The high average scores in basic technology use suggest that students are comfortable with digital tools, while lower proficiency in more advanced applications indicates a need for further training. The study highlights the importance of integrating the Common European Framework of Reference for Languages (CEFR) with easy-to-use technologies in language learning. In conclusion, to enhance language education, it is crucial to provide professional development programs, design intuitive applications, and implement supportive policies. This approach can bridge proficiency gaps and ensure effective, engaging language learning experiences.

***Keywords:*** *CEFR, Educational technology, Language acquisition, Language proficiency, Malaysia, Mobile application.*

## 1. Introduction

In a society characterised by growing globalisation and multicultural contacts, the acquisition of language ability has become increasingly vital. Language acquisition encompasses more than the mere memorization of vocabulary and phrases; it serves as a means to comprehend various cultures, facilitate global relationships, and expand one's perspectives [1]. Educational technology has arisen as a transformational force, meeting the changing demands of language learners and bringing about a new era of language acquisition. This article explores the intricate relationship between language


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* Correspondence: ahmadzaki@umk.edu.my

acquisition, the Common European Framework of Reference for Languages (CEFR), and the inventive utilisation of technology to develop language learning applications that cater to learners with different levels of proficiency.

Language acquisition is a complex pursuit that provides individuals with both the capacity to speak proficiently and the tools to interact with the environment on a deeper level. Language acquisition, whether for travel, business, or personal enrichment, enables individuals to master a second language, thereby facilitating access to other cultures and fostering cross-cultural understanding [2, 3]. Fluency in many languages is becoming more and more valuable since it helps establish relationships in a highly integrated global culture. The process of acquiring a language involves more than just memorising vocabulary and grammar rules; it also entails developing the ability and self-assurance to communicate in many real-life situations effectively [4, 5].

The Common European Framework of Reference for Languages (CEFR) is the central foundation of contemporary language instruction. The Council of Europe has developed a framework that provides a standardised method for assessing language ability in several European languages. Language proficiency is categorised into six categories, spanning from A1 (beginner) to C2 (proficient). The CEFR serves as a universal benchmark that surpasses language barriers, enabling learners, educators, and employers to evaluate and comprehend language proficiency consistently. Consequently, the CEFR has emerged as a great instrument for individuals to assess their language proficiency and methodically track their advancement. Furthermore, it has achieved worldwide acclaim and is commonly used outside of Europe as a standard for measuring language competency.

The advent of the digital era has fundamentally transformed the domain of acquiring linguistic skills [6]. Due to the emergence of technology, learners today have a wide range of advanced tools and resources at their disposal to assist them in their language acquisition process. The utilisation of mobile applications, internet platforms, and interactive software has revolutionised the learning process, enhancing its interactivity, convenience, and customization [6, 7]. These technological advancements have not only made language education available to a larger group of people, but they have also improved the efficiency and efficacy of learning languages. Technology has become an essential tool for language learners of all ages and backgrounds, including interactive exercises, multimedia information, and artificial intelligence-powered feedback [8]. Integrating CEFR-based language learning tools in this context is a significant advancement in aligning technology with standardised competency benchmarks. It provides learners with a systematic and goal-oriented method for acquiring language skills. These programmes generally incorporate a variety of language proficiency levels and tests, enabling learners to establish precise language learning objectives and methodically monitor their advancement.

The combination of these three elements—language acquisition, the Common European Framework of Reference for Languages (CEFR), and educational technology—highlights the transformation of language education into a more organised, individualised, and universally standardised pursuit. In the following sections, we will examine the advantages, characteristics, and potential influence of CEFR-based language learning programmes on the process of acquiring language skills.

### *1.1. Research Background and Literature Review*

The incorporation of the Common European Framework of Reference for Languages (CEFR) into the Malaysian educational system is a significant milestone in the effort to establish uniform language proficiency standards and evaluation criteria. Malaysia, a nation renowned for its wide variety of languages, has adopted the CEFR as a guiding framework to unify language teaching standards across different levels of the school system. The Malaysian Qualifications Agency (MQA) has taken the lead in incorporating the Common European Framework of Reference for Languages (CEFR) into curriculum creation and language assessment practices, acknowledging the importance of aligning national qualifications with international standards. Hence, the CEFR's impact can be seen in language

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programmes throughout many levels of education in Malaysia, ranging from primary and secondary schools to higher education institutions, offering a well-organised basis for language acquisition.

The language acquisition trends seen among university students in Malaysia reflect the diverse cultural composition of the country, which covers a wide range of languages, including Malay, English, and various other languages that hold a major position. The English language plays a crucial role as a global lingua franca, demanding significant attention and effort from students who aim to improve their abilities [9]. The drive to achieve fluency in English frequently stems from the aspiration to enhance employability, expand academic opportunities, and facilitate global communication. Concurrently, a predilection for additional foreign languages, such as Arabic, Mandarin, and Japanese, also arises as a result of variables such as job opportunities, cultural curiosity, and individual ambitions. The interaction between several factors, such as linguistic diversity, socioeconomic impacts, and educational objectives, determines the patterns of language acquisition [10]. As a result, Malaysian university students are required to take a sophisticated approach to language instruction.

The educational landscape in Malaysia has undergone a significant transformation due to the increasing incorporation of technology in language learning [4]. The proliferation of online platforms, mobile applications, and e-learning materials has provided students with creative and engaging means to gain language skills. This shift has been significantly expedited by unexpected occurrences, such as the COVID-19 epidemic, which required the swift implementation of remote and digital learning solutions. Aligned with the Malaysian government's dedication to digitalizing education, as stated in the Malaysia Digital Economy Blueprint, integrating technology into language teaching has become a crucial element of modern learning methods in the country. Technology's ongoing impact on language learning holds the potential to provide greater accessibility and efficacy, rendering it a crucial element of language education in Malaysia.

The alignment of the Common European Framework of Reference for Languages (CEFR) with technology presents a highly favourable opportunity to transform the process of language acquisition in Malaysia completely. This integration enables the creation of technology-based language learning applications and platforms that easily conform to the standardised structure of the CEFR. Through the integration of digital resources and CEFR language abilities, instructors can provide students with systematic and purpose-driven language training [2]. The use of technology enhances the potential of language learning programmes based on the Common European Framework of Reference for Languages (CEFR), allowing for personalised learning experiences [11]. These adaptive tools guarantee that both the content and tests are customised to match the progress of each learner, improving the effectiveness of language acquisition. The incorporation of CEFR into technology not only enhances standardised language proficiency but also promotes equal access to high-quality language education, fostering inclusiveness in a linguistically varied nation. This study focuses on the precise procedures and strategies used to develop language learning materials that are integrated with the Common European Framework of Reference for Languages (CEFR). It also examines the effects of these resources on the language acquisition of university students in Malaysia.

## 2. Method

The study aims to utilise a quantitative survey method to provide significant insights on the incorporation of the Common European Framework of Reference (CEFR) with technology for language learning. Additionally, it seeks to provide a thorough understanding of students' viewpoints and experiences in Malaysian higher education institutions. In order to fulfil the research aims, this study utilises a quantitative research methodology. The main approach to collecting data is to conduct a well-organised survey specifically designed to obtain quantitative information from a significant number of students enrolled in higher education institutions in Malaysia. The quantitative approach is selected due to its capacity to facilitate systematic data collection, analysis, and the production of statistically significant findings pertaining to the amalgamation of the Common European Framework of Reference for Languages (CEFR) with technology for language acquisition.

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*2.1. Sampling and Data Collection*

The study's target demographic comprises students currently enrolled in higher education institutions in Malaysia. In order to ensure that the study is representative and can be applied to a larger population, a group of 60 students were chosen using a simple random selection technique. This approach involves allocating an equal probability to each individual in the population to be chosen as a sample member, thereby guaranteeing an impartial and methodical pattern-free selection process.

*2.2. Instrument*

A meticulously crafted survey questionnaire is created to gather data. The questionnaire comprises a sequence of closed-ended inquiries that will enable respondents to furnish precise numeric solutions. The purpose of this study is to investigate many aspects of language learning and the integration of technology. This includes examining students' knowledge of the Common European Framework of Reference for Languages (CEFR), their use of technology for language learning, and their opinions on the usefulness of language learning programmes based on the CEFR. The questionnaire will additionally gather demographic information in order to classify and analyse the results based on pertinent characteristics.

*2.3. Procedure for Collecting Data*

The survey will be disseminated to the chosen cohort of students in tertiary educational establishments in Malaysia. Participants will be contacted via a combination of online and in-person approaches, guaranteeing a broad representation of students from various academic disciplines and geographical areas. Email and educational platforms will be used to distribute online surveys, while on-site data collection will entail visiting educational institutions to distribute and collect completed surveys. The respondents will be presented with a comprehensive and precise description of the study's objectives, the confidentiality of their responses, and the voluntary nature of their participation to guarantee informed consent.

*2.4. Ethical Considerations*

The research will strictly conform to ethical rules and principles. All participants will be required to provide informed consent, which includes being fully informed about the study's objectives, the confidentiality of their responses, and their right to withdraw from the study at any time. The survey will be formulated to gather de-identified data, and the identities of all participants will be maintained in strict confidence. The research will adhere to the data protection and privacy rules applicable to Malaysia.

## 3. Findings and Discussion

A survey consisting of a collection of questionnaires was issued to 60 students at the tertiary level to ascertain the requirements of users in designing a language learning application based on the Common European Framework of Reference for Languages (CEFR). The outcomes are as follows.

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**Table 1.**
Users' need and competencies.

| No | Item | Mean | SD |
|---|---|---|---|
| 1 | Using a computer/laptop | 3.79 | 0.589 |
| 2 | Using a tablet/iPad | 3.82 | 0.584 |
| 3 | Using a smartphone | 4.21 | 0.663 |
| 4 | Using technology tools to search for information on the Internet | 3.86 | 0.678 |
| 5 | Using technology tools to communicate via email | 4.04 | 0.733 |
| 6 | Using technology tools to listen to audio and watch videos on the Internet | 4.21 | 0.692 |
| 7 | Using technology tools to chat on the Internet | 4.14 | 0.663 |
| 8 | Using word processing applications | 4.07 | 0.663 |
| 9 | Using presentation software applications | 4.04 | 0.663 |
| 10 | Using spreadsheet software applications | 3.86 | 0.781 |
| 11 | Using graphic design software | 3.57 | 0.831 |
| 12 | Using multimedia applications for learning | 3.71 | 0.745 |
| 13 | Using time management software applications | 3.64 | 0.780 |
| 14 | Using language learning software applications | 3.75 | 0.756 |
| 15 | Using social media tools | 4.21 | 0.663 |
| 16 | Using video editing software applications | 3.68 | 0.801 |
| 17 | Using audio editing software applications | 3.68 | 0.801 |
| 18 | Using software applications for self-learning | 3.86 | 0.781 |
| 19 | Using software applications for collaborative learning | 3.86 | 0.678 |
| 20 | Using software applications for testing and assessment | 3.96 | 0.700 |
| 21 | Using software applications for lesson planning | 3.96 | 0.700 |
| 22 | Using software applications for classroom management | 3.96 | 0.700 |
| 23 | Using software applications for learning assessment | 3.96 | 0.700 |
| 24 | Using software applications for research | 3.86 | 0.678 |
| 25 | Using software applications for professional development | 3.86 | 0.678 |
| 26 | Using software applications for collaboration | 3.86 | 0.678 |
| 27 | Using software applications for communication | 4.07 | 0.663 |
| 28 | Using software applications for simulation | 3.86 | 0.678 |
| 29 | Using software applications for gamification | 3.68 | 0.801 |
| 30 | Using software applications for feedback | 3.96 | 0.700 |
| 31 | Using software applications for adaptive learning | 3.86 | 0.781 |
| 32 | Using software applications for face-to-face teaching | 3.96 | 0.700 |
| 34 | Using software applications for online teaching | 3.96 | 0.700 |
| 35 | Using software applications for blended teaching | 3.96 | 0.700 |
| 36 | Using software applications for monitoring student progress | 3.96 | 0.700 |
| 37 | Using software applications for administrative management | 3.96 | 0.700 |
| 38 | Using software applications for documentation | 3.96 | 0.700 |
| 39 | Using software applications for resource sharing | 3.96 | 0.700 |
| 40 | Using software applications for research management | 3.96 | 0.700 |

The result above provides a detailed analysis of users' needs and competencies in utilizing various technological tools and applications pertinent to language learning based on the Common European Framework of Reference for Languages (CEFR). The overall high mean scores across different items suggest that users generally possess a competent to highly competent level of proficiency in using these technologies. However, the variability in standard deviations indicates differing degrees of familiarity and expertise, pointing towards specific areas that require targeted development and support.

The data reveals that users exhibit high proficiency in basic technological skills such as using computers, tablets, and smartphones. For instance, items like " Using a computer/laptop " and "Using a smart phone" have mean scores of 3.79 and 4.21, respectively, with relatively low standard deviations (0.589 and 0.663). This indicates a consistent level of comfort and skill among users when employing these essential devices. Such proficiency is crucial for the successful implementation of a language learning application, as it ensures that users can easily navigate and utilize the fundamental features of the application. When analysing the use of specific applications related to language learning, the data

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indicates a slightly lower proficiency level with greater variability. For example, the use of graphic design software has a mean score of 3.57 and a standard deviation of 0.831, suggesting that while some users are adept, others may struggle with such specialized tools. Similarly, applications for video and audio editing also show moderate mean scores (3.68) and higher standard deviations (0.801). This highlights the need for targeted training and support to enhance user skills in these areas, which are vital for creating engaging and interactive language learning content.

Besides, the proficiency in using educational software and tools for classroom management, lesson planning, and student assessment is generally high, with mean scores around 3.96 and lower standard deviations (0.700). This indicates that users are comfortable using these tools for educational purposes, which is promising for the development of a comprehensive language-learning application. However, the data also points to a need for improvement in the adoption of more advanced educational technologies, such as gamification and simulation tools, which have mean scores of 3.68 and standard deviations of 0.801 and 0.678, respectively. Enhancing user proficiency in these areas can significantly enrich the learning experience and engagement.

In addition, the result underscores the importance of aligning the language learning application with the CEFR standards, which provide a clear framework for language proficiency levels. The consistent use of these standards can help in designing the application to cater to users' specific language learning needs effectively. The high mean scores in using technologies for communication and information retrieval (4.04 and 3.86) suggest that users are well-equipped to handle applications that facilitate these functions. However, the development process should prioritize making advanced functionalities, like interactive and multimedia content creation, more accessible and user-friendly to bridge the proficiency gaps identified in the dataset.

Hence, based on the analysis, it is recommended that the development of the language learning application should focus on enhancing user skills in specialized and advanced technological applications. Professional development programs should be implemented to train users in using graphic design, video, and audio editing software, as well as gamification and simulation tools. Additionally, the application should be designed to be intuitive and user-friendly, with clear guidance and support features to assist users with varying levels of technological proficiency. By addressing these needs, the application can effectively support language learning in alignment with CEFR standards, ensuring a comprehensive and engaging learning experience for all users.

## 4. Discussion

The analysis of the dataset reveals significant insights into the technological proficiency of users and their needs for developing a language learning application aligned with the Common European Framework of Reference for Languages (CEFR). Despite the generally high level of proficiency in basic technological skills, the variability in specialized application use highlights areas requiring targeted intervention. This discussion aims to explore the underlying reasons for these findings and propose strategic measures to address these issues.

The high mean scores for basic technological skills, such as using computers and smartphones, indicate that most users are comfortable with these fundamental tools. However, the greater variability in proficiency with specialized applications, such as graphic design and multimedia editing software, suggests several underlying issues. First, the differential exposure to and training in these applications can lead to inconsistent skill levels. Users in educational settings might have varying degrees of access to these technologies and opportunities for professional development. Additionally, the complexity of specialized software often requires more extensive training and practice, which may not be uniformly available or prioritized in all educational contexts [12].

This variability in technological proficiency poses a challenge to the development of a comprehensive language-learning application. Users' limited skills in creating and using interactive and multimedia content can hinder the effective integration of advanced educational technologies, such as gamification and simulation tools, into the learning environment [13]. These tools are essential for

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creating engaging, interactive, and immersive learning experiences that are aligned with CEFR standards. The lower mean scores and higher standard deviations for these advanced tools underscore the need for a user-centric design approach that accommodates varying levels of proficiency and provides adequate support and training.

To resolve these issues, it is crucial to implement targeted training programs aimed at enhancing users' skills in specialized technological applications [14]. Professional development initiatives should focus on equipping educators and learners with the necessary competencies to effectively use graphic design, video, and audio editing software. These programs should be designed to be accessible, practical, and aligned with the users' specific needs and contexts [14, 15]. Additionally, incorporating regular, hands-on training sessions and workshops can help users gain confidence and proficiency in these tools, ultimately leading to more effective and engaging language learning experiences.

Another key strategy is to develop a language learning application with a strong emphasis on user-friendliness and accessibility. The application should include intuitive interfaces, clear instructions, and built-in tutorials that guide users through the process of using advanced features. By simplifying the user experience and providing robust support mechanisms, the application can help bridge the proficiency gap and enable users to utilize all available tools effectively. Furthermore, integrating adaptive learning technologies can personalize the learning experience, offering users customized support and resources based on their proficiency levels.

Finally, policy and institutional support play a crucial role in addressing these technological proficiency issues. Educational institutions should prioritize the integration of advanced technological training into their curricula and provide adequate resources and infrastructure to support this. Policies that encourage ongoing professional development and the continuous improvement of technological skills among educators and learners are essential. By fostering a culture of technological competence and innovation, institutions can ensure that their users are well-prepared to leverage advanced tools and applications for effective language learning.

## 5. Conclusion

In conclusion, the analysis of the dataset highlights the need for targeted interventions to enhance users' proficiency in specialized technological applications. Addressing the variability in technological skills is crucial for the successful development and implementation of a language learning application aligned with CEFR standards. Through targeted training programs, user-friendly application design, and robust policy support, educational institutions can equip users with the necessary competencies to fully leverage advanced educational technologies, thereby enriching the language learning experience and achieving better learning outcomes

## Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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## References

[1] N. Schmitt and D. Schmitt, *Vocabulary in language teaching*, 2nd ed. Cambridge University Press. https://doi.org/10.1017/9781108569057, 2020.

[2] L. Lu, I. A. Wong, and Y. Zhang, "Second language acquisition and socialization in international trips," *Journal of Hospitality and Tourism Management*, vol. 47, pp. 1-11, 2021. https://doi.org/10.1016/j.jhtm.2021.02.007

[3] W. A. A. W. Daud, M. T. A. Ghani, A. Z. Amiruddin, K. A. Ghani, and A. A. Rahman, "The usability of i-Suyyah: A mobile tourism application for Arab tourists in Malaysia," *Enlightening Tourism. A Pathmaking Journal*, vol. 11, no. 1, pp. 263-286, 2021. https://doi.org/10.33776/et.v11i1.5090

[4] M. T. Abdul Ghani, M. Hamzah, W. A. A. Wan Daud, and T. R. Muhamad Romli, "The impact of mobile digital game in learning arabic language at tertiary level," *Contemporary Educational Technology*, vol. 14, no. 1, p. ep344, 2022. https://doi.org/10.30935/cedtech/11480

[5] R. Robert and S. Meenakshi, "Rereading oral communication skills in English language acquisition: The unspoken spoken English," *Theory and Practice in Language Studies*, vol. 12, no. 11, pp. 2429-2435, 2022. https://doi.org/10.17507/tpls.1211.25

[6] M. T. A. Ghani, W. A. A. W. Daud, and K. A. Manan, "Integration of the ARCS motivational model in digital game-based learning for sustaining student engagement in communication," *International Journal of Religion*, vol. 5, no. 5, pp. 85-93, 2024. https://doi.org/10.61707/sa9ded72

[7] M. Diao and J. G. Hedberg, "Mobile and emerging learning technologies: Are we ready?," *Educational Media International*, vol. 57, no. 3, pp. 233-252, 2020. https://doi.org/10.1080/09523987.2020.1824422

[8] N. S. Sharifuddin and H. Hashim, "Benefits and challenges in implementing artificial intelligence in education (AIED) in ESL classroom: A systematic review (2019-2022)," *International Journal of Academic Research in Business and Social Sciences*, vol. 14, no. 1, pp. 146-164, 2024. https://doi.org/10.6007/ijarbss/v14-i1/20422

[9] Z. Köylü and N. Tracy-Ventura, "Learning English in today's global world: A comparative study of at home, anglophone, and lingua franca study abroad," *Studies in Second Language Acquisition*, vol. 44, no. 5, pp. 1330-1355, 2022. https://doi.org/10.1017/s0272263121000917

[10] E. Kidd and R. Garcia, "How diverse is child language acquisition research?," *First Language*, vol. 42, no. 6, pp. 703-735, 2022. https://doi.org/10.31234/osf.io/jpeyq

[11] L. Kupchyk and A. Litvinchuk, "Constructing personal learning environments through ICT-mediated foreign language instruction," presented at the Journal of physics: Conference Series, IOP Publishing, 2021.

[12] J. Wiziack and V. Dos Santos, "Evaluating an integrated cognitive competencies model to enhance teachers' application of technology in large-scale educational contexts," *Heliyon*, vol. 7, no. 1, p. e05928, 2021.

[13] B. North, E. Piccardo, T. Goodier, D. Fasoglio, R. Margonis-Pasinetti, and B. Rüschoff, "Enriching 21st-century language education, the CEFR companion volume in practice," 2022.

[14] D. Checa and A. Bustillo, "A review of immersive virtual reality serious games to enhance learning and training," *Multimedia Tools and Applications*, vol. 79, no. 9, pp. 5501-5527, 2020.

[15] A. R. Dopp, K. E. Parisi, S. A. Munson, and A. R. Lyon, "Aligning implementation and user-centered design strategies to enhance the impact of health services: Results from a concept mapping study," *Implementation Science Communications*, vol. 1, pp. 1-13, 2020. https://doi.org/10.1186/s43058-020-00020-w