

Original Article

A Measuring Tool for Assessing Digital Literacy Competence among Mandarin Language Students

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Received: 15 July 2024

Revised: 07 October 2024

Accepted: 17 October 2024

Published: 25 October 2024

Abstract - The absence of a dedicated instrument for assessing the digital literacy of students in the Mandarin Language Educational Program prompted the research team to develop the "Digital Literacy" (数字素养 - Shùzì sùyǎng) instrument. Given the significance of digital literacy in the contemporary 5.0 era and the lack of a suitable tool, this research addresses the gap by introducing a comprehensive instrument. The instrument was validated by two expert validators, comprising four dimensions—social-emotional, cognitive, technical, and attitudinal. Subsequent limited testing assessed the validity and reliability of formulated question items. The validity test confirmed the instrument's appropriateness using a Likert scale with four answer categories. Results from testing the digital literacy of Mandarin language education students further validated the instrument, supported by calculated R-values surpassing the r-table value. A reliability test, with a Cronbach's Alpha value exceeding 0.6, attests to the questionnaire's consistency and reliability in measurement.

Keywords - Digital literacy, Assessment, Students, Mandarin language, Measuring tool.

1. Introduction

In the 21st century, global development is occurring rapidly in the technology and information sector. The realm of education serves as the forefront for the young generation of Indonesia. Therefore, this century's learning quality must continually evolve and adapt to technological advancements. [1] Budiman (2017:41) asserts that using technology in education is essential for learning, aiming to maximize learning efficiency. Technological developments are expected to equip educators with the skills to operate it and enable students from elementary to university levels to use information technology proficiently in their educational journey. As an example, [2] Helena et al. have developed an interactive media, "Kids Learn Mandarin," for Indonesian students learning Mandarin language, and [3] Faradilla et al. have developed 中印节日 [zhōngyayinjieri] media based on Powtoon. [4] Griffin and Care (2015) further emphasize the importance of 21st-century skills, specifically digital literacy technology skills. According to a 2022 Indonesian Internet Service Providers Association (APJII) survey, internet penetration among Bachelor's or Diploma degree holders is 98.39%. The learning process in the Mandarin Language Study Program at the State University of Malang and the State University of Surabaya has been integrated with technology. Mandarin Language Program's learning takes place through both offline (face-to-face) and online (synchronous and asynchronous) methods. Online

learning demands. In response, Mandarin language students must possess digital literacy skills. They must conduct in-depth analyses of the information acquired from Internet sources, as suggested by [7] Fitriyani and Mukhlis (2021), emphasizing the need for students to analyze data from the Internet critically. Since university students are considered capable of conducting internet-based learning due to their independence and maturity in handling information, they need to develop digital literacy skills. An appropriate measurement tool is required to assess the level of digital literacy among Mandarin Language Education students. [8] Karitas and Suwarsono (2023) assert that in order for pupils to map the level of their proficiency with digital technology, suitable measuring tools are required. Currently, no instrument is available for measuring the digital literacy level of Mandarin Language Education students, especially for Mandarin learners in Indonesia. Previous journals on digital literacy levels in Mandarin did not use questionnaires as instruments, for example, [9] Jun and [10] Wahyuwardhani. Meanwhile, another journal on digital literacy does not measure digital literacy for Mandarin language learners or is not specifically mentioned for Mandarin language learners, for example, [11] Sidauruk (2021) and Karitas [8]. Therefore, the lack of a suitable instrument and the importance of students' digital literacy skills in the 5.0 era prompted the research team to develop an instrument tailored to measure Mandarin Language Education students' digital



literacy skills. The developed instrument will be called the "Digital Literacy" instrument. The name "Digital Literacy" was chosen because it means digital literacy in Mandarin. So, "the instrument Digital Literacy" means digital literacy instrument. This research aims to develop an instrument named "Digital Literacy" to measure the digital literacy level of Mandarin Language Education students across Indonesia, specifically at the State University of Malang and the State University of Surabaya. The outcome of this research is that the Mandarin Language Education Program will have an instrument to measure students' digital literacy levels. The developed instrument is tailored to the characteristics of Mandarin Language Education students, allowing both students and educators to understand the students' digital literacy levels, ultimately enhancing students' digital learning skills.

Learning technology is a part of educational technology where human beings, procedures, and tools are interconnected to solve problems. Meanwhile, [12] Ramli (2012) defines learning technology as a systematic effort to design, implement, develop, and evaluate a learning process to ensure its effectiveness. One of the purposes of utilizing technology in education is to create various learning innovations, optimize the learning process, and achieve maximum results [13] Ahmadi and Khoiriyah (2020). One emerging e-learning method is the Learning Management System (LMS). LMS is an educational innovation that applies e-learning concepts and appears to be an actual product in online learning processes [14] (Syaakir Ni'am et al., 2013). The implementation of e-learning in education demands that students have digital literacy skills.

Hasliyah (2022) [5] describes digital literacy as the skills individuals possess to obtain, understand, and process information from various digital sources. The diversity of information sources available on the Internet or other digital platforms requires students to filter received information more accurately. According to Aini (2022), there are three dimensions of multiliteracies skills in digital literacy. The first is the technical dimension, involving essential mastery of digital technology and critical thinking skills. The second dimension is the cognitive dimension, emphasizing critical thinking skills, information literacy, and others. In this dimension, the focus is on understanding critical thinking and creating and evaluating digital information. The third dimension is the social-emotional dimension, which includes vital and emotional literacy.

Sidauruk (2021) [11] shows that the procedure for developing the Digital Literacy Assessment Scale (DLAS) instrument includes three stages: determining the instrument's construct and specifications, comprising three parts: analysis, defining conceptual and operational definitions, and determining indicators. The study involves domain analysis, target analysis, and goal analysis.

Writing instrument items are constructed from indicators that elaborate on certain aspects. The items are then arranged into a Likert scale with four answer choices: TP (Never), J (Rarely), S (Often), and SL (Always). After the statement items are completed, item analysis will be conducted. Five expert judgments carry out this analysis process to validate the instrument's content. The DLAS instrument comprises three aspects, tailored by several experts and detailed in each indicator.

Digital Literacy across the Curriculum [15] was chosen as the theoretical basis for developing this instrument because this theory provides a comprehensive approach to understanding and measuring digital literacy. These components: creativity, communication, collaboration, critical thinking, citizenship, culture, functional skills, and electronic security cover the essential competencies needed for effective digital engagement in education. By incorporating these dimensions into the questionnaire, educators can assess students' ability to not only use digital devices but also engage in higher-order thinking, collaborate in digital environments, and navigate the ethical and security aspects of the online world. This holistic view ensures that digital literacy is not just about technical skills but also about fostering responsible, creative, and critical digital citizens.

In this study, digital literacy is intended for students of the Mandarin language study program using Chinese-made applications such as Voov, WeChat, QQ, and Youku, including the ability to understand, use, and operate digital features that support language learning. Students must be able to utilize video conferencing platforms (such as Voov) for online classes, use WeChat and QQ to communicate with native speakers or study partners and access audio-visual content on Youku to improve their understanding of Mandarin culture and language. In addition, digital literacy also includes a sense of privacy, security, and ethics when interacting in the digital space.

Research conducted by Asyti Febliza and Oktariani titled "Pengembangan Instrumen Literasi Digital Sekolah, Siswa dan Guru" (Development of Digital Literacy Instruments for Schools, Students, and Teachers) aimed to develop and measure the extent of digital literacy levels among schools, teachers, and students. The research involved 90 respondents, 30 teachers, 60 SMA Negeri, and 14 Pekanbaru students. The conclusion drawn from this research is that the digital literacy questionnaire for schools, teachers, and students can be used as a data collection tool, with over 60% of the questions having a high level of validity and acceptable consistency. Another study by Riswanti Rini et al., titled "Literasi Digital Mahasiswa dan Faktor – Faktor yang Berpengaruh" (Students digital literacy and Influencing Factors), aimed to identify internal factors affecting students' digital literacy. The quantitative research method involved 656 student respondents from various universities in

Indonesia. Data was collected using a questionnaire compiled into Google Forms, adjusting for curiosity, self-determination, and digital literacy indicators. The data analysis technique used multiple linear regression statistical tests preceded by classic assumption tests. The results showed that curiosity and self-determination positively and significantly impacted digital literacy.

A study by Deci Ririen and Febblina Daryanes titled Analysis of Student Digital Literacy aimed to analyze students' digital literacy abilities concerning their study duration, gender, and employment status. This descriptive quantitative research concluded that students' technology usage skills were good, with an achievement percentage of 81%. Students' abilities in online communication, critical thinking, and standards for technology use were rated as moderate, with percentages of 76.6%, 75.6%, and 70%. Furthermore, digital literacy skills were higher for students with two semesters (77.8%) study duration than those with four semesters (76.6%).

2. Materials and Methods

This research is a development and research type that utilizes the [16] Plomp development model. The development model consists of stages beginning with an introduction, then the prototyping stage, and concluding with the assessment stage. Derived from these stages, the research model is divided into five phases: (1) initial analysis, (2) design, (3) implementation, (4) testing, evaluation, and revision, and (5) implementation (Plomp & Nieveen, 2010), illustrated with the following flowchart:

Two expert validators validate the "Digital Literacy" instrument prepared. The State University of Malang and the State University of Surabaya are educational universities in Indonesia. The expert validators selected in this study are Mandarin language lecturers who also teach digital learning media courses for Mandarin language learners. Thus, the two

validators are considered to have expertise in learning technology and understand the context of digital learning media used in Mandarin language learning. Once deemed valid, the instrument undergoes limited testing to calculate the validity and reliability levels of the formulated questions. Testing is conducted on the predetermined sample to determine the validity and reliability levels.

The population for this study consists of students from the Mandarin Language Education Program at the State University of Malang and the State University of Surabaya, with a total of 571 students. Sampling in this study used a random sampling technique and the Slovin formula, with 155 students selected. Trial sample students are chosen from the 2020 cohort (semester 6), the 2021 cohort (semester 4), and the 2022 cohort (semester two or new students). Each question item is formulated by developing a question matrix using a Likert scale with four answer categories. All obtained data are then analyzed using SPSS to measure the levels of validity and Reliability. The calculation of validity and reliability levels is performed using MS Excel with the product-moment correlation formula:

$$r_{XY} = \frac{n \sum XY - (\sum X)(\sum Y)}{\sqrt{(n \sum X^2 - (\sum X)^2)(n \sum Y^2 - (\sum Y)^2)}}$$

Explanation:

- r_{XY} = Correlation coefficient between variable X and variable Y
- ∑XY = sum of the product of variables X and Y
- ∑X² = Sum of the square of values X
- ∑Y² = Sum of the square of values Y (∑X)² = Sum of values X squared
- (∑Y)² = Sum of values Y squared

The validity of each instrument item is determined based on the calculated r-value, where an item is considered valid if the r-value > r-table. The validity categories are outlined by Sugiyono (2016):

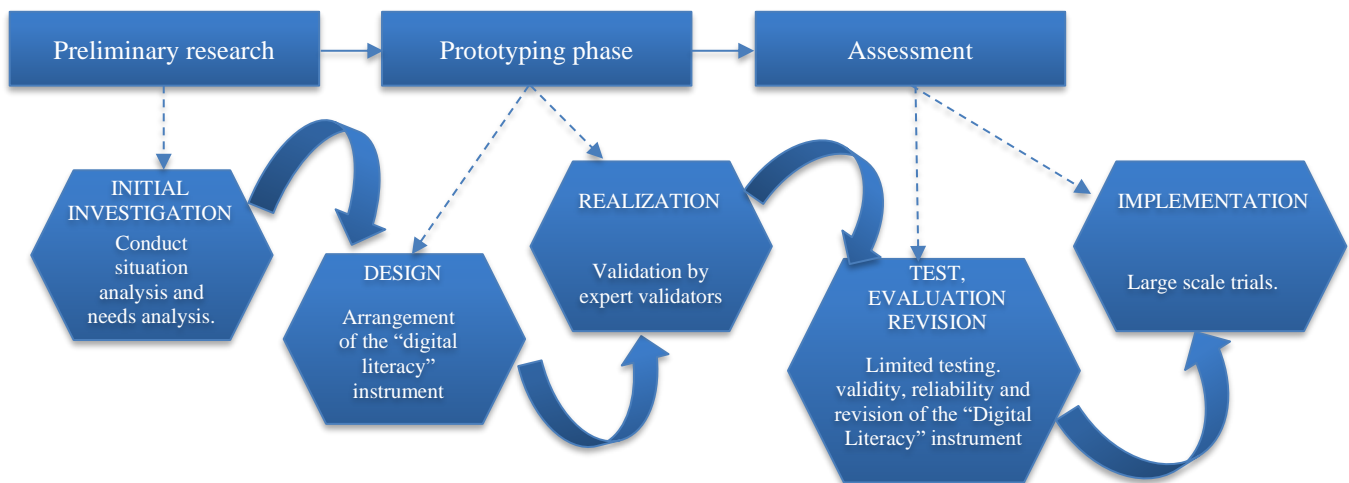


Fig. 1 Development model

Table 1. Validity categories

Score	Category
$0.80 < r_{xy} \leq 1.00$	very good
$0.60 < r_{xy} \leq 0.80$	good
$0.40 < r_{xy} \leq 0.60$	fair
$0.20 < r_{xy} \leq 0.40$	less
$0.00 < r_{xy} \leq 0.20$	bad
$< r_{xy} \leq 0.00$	invalid

3. Results and Discussion

3.1. Expert Validator

This instrument is designed according to the needs of Mandarin language learners so that the statements in each item of this questionnaire are expected to be in accordance with the conditions of Mandarin digital literacy. The team incorporated elements of technology used in China, such as Voov, QQ, WeChat and so on. [8] Karitas and Suwarsono (2023) state that there is a need for appropriate measuring instruments so that students can map the extent of their ability to utilize and understand digital technology efficiently.

After formulating the "Digital Literacy" instrument, the team conducted a validation test with two instrument validators on July 3, 2023. The research team used a questionnaire to gather information, assess the material's appropriateness, and note the suggestions for revising the product. The developed instrument obtained a percentage of 90.6% from the material validation conducted.

The material validators assessed eight indicators. Five indicators scored the maximum score of 4, representing 100%, namely:

1) Clarity of indicator descriptions and questionnaire filling instructions, 2) Clarity of indicator descriptions and questionnaire filling instructions, 3) The questionnaire items assess five aspects of digital literacy, including functional skills and more, such as creativity, collaboration, communication, information search and selection, critical thinking and evaluation, as well as e-safety. 4) The statements in the questionnaire are suitable for extracting the intended information, and 5) The statements in the questionnaire are sufficient to extract the intended information.

Additionally, three indicators scored 3 with a percentage of 75%, including 1) The statements in the questionnaire do not have biased meanings, 2) The questionnaire is easy to fill, and 3) The sentences used in the questionnaire conform to proper Indonesian language methods. The second validator assessed the developed instrument with a percentage of 93.7%, with six indicators scoring the maximum score of 4 and two indicators scoring 3 with a rate of 75%. Based on the category table, Sugiyono (2016), the results of the two expert validations are categorized as very good. However, there are suggestions for the perfection of the instrument being developed, namely revising the statement sentences with biased meanings and reformulating the instrument sentences to be more efficient.

Table 2. First validation expert result

No	Description	Rating Scale				X	Xi	(%)
		STS	ST	S	SS			
1	The explanation and guidelines for completing the questionnaire are clear.				√	4	4	100%
2	The details and directions for completing the questionnaire are simple to comprehend				√	4	4	100%
3	Statements in the questionnaire can measure eight components of digital literacy, including creativity, functional skill and beyond, collaboration, the ability to find and select information, communication, critical thinking and evaluation, and e-safety.				√	4	4	100%
4	The statements in the questionnaire do not have biased meanings.			√		3	4	75%
5	The questionnaire is easy to fill in.			√		3	4	75%
6	The sentences in the questionnaire are by excellent and correct Indonesian language rules.			√		3	4	75%
7	The statements in the questionnaire are appropriate for digging up the information you want to dig up.				√	4	4	100%
8	The questionnaire overall is good.				√	4	4	100%
	$\sum x$					29		
	$\sum xi$						32	
	p							90,6%

Table 3. Second validation expert result

No	Description	Rating Scale				X	Xi	(%)
		STS	ST	S	SS			
1	The explanation and guidelines for completing the questionnaire are clear.				√	4	4	100%
2	The details and directions for completing the questionnaire are simple to comprehend				√	4	4	100%
3	Statements in the questionnaire can measure eight components of digital literacy, including creativity, functional skill and beyond, collaboration, the ability to find and select information, communication, critical thinking and evaluation, and e-safety.				√	4	4	100%
4	The statements in the questionnaire do not have biased meanings.				√	4	4	75%
5	The questionnaire is easy to fill in.			√		3	4	75%
6	The sentences used in the questionnaire are excellent and correct Indonesian language rules.			√		3	4	75%
7	The statements in the questionnaire are appropriate for digging up the information you want to dig up.				√	4	4	100%
8	The questionnaire is overall good.				√	4	4	100%
	$\sum x$					30		
	$\sum xi$						32	
	P							93,75%

Table 4. Validity test results

No	Statement	r count	r table	Description
1	I can operate a computer /laptop /smartphone	0,516	0,159	Valid
2	I can use the internet to search for materials from valid Mandarin language teaching sources.	0,575	0,159	Valid
3	I can create Mandarin language products using simple digital technology (PPT, animation, poster, etc.)	0,556	0,159	Valid
4	I can think creatively	0,565	0,159	Valid
5	I can think imaginatively	0,64	0,159	Valid
6	I can participate in digital spaces	0,589	0,159	Valid
7	I can explain ideas to others in groups in digital spaces	0,323	0,159	Valid
8	I can play an active role (asking, answering, giving comments, suggestions, etc.) in the digital space	0,362	0,159	Valid
9	I can communicate through digital technology media	0,522	0,159	Valid
10	I cannot search for information in the digital space	0,444	0,159	Valid
11	I can select information in the digital space	0,495	0,159	Valid
12	I can analyze various information that I need related to Mandarin in the digital space	0,485	0,159	Valid
13	I can think critically when interacting in digital spaces	0,553	0,159	Valid
14	I can safely explore Chinese information on various digital platforms	0,493	0,159	Valid
15	I can safely create on various digital platforms	0,643	0,159	Valid
16	I collaborate on various digital platforms safely	0,565	0,159	Valid
17	I can follow learning using the Zoom application	0,546	0,159	Valid
18	I can operate Zoom skillfully, such as a microphone, chat forum, video background, share screen, etc.	0,562	0,159	Valid
19	I can follow learning using the Google Meet application	0,628	0,159	Valid
20	I can use a microphone, chat forum, video background, and share screen, and I can use Google Meet skillfully.	0,527	0,159	Valid
21	I can follow learning using the VooV application	0,573	0,159	Valid
22	I can operate VooV skillfully, using a microphone, chat forum, video background, share screen, etc.	0,58	0,159	Valid
23	I have an Email	0,658	0,159	Valid
24	I actively use Email	0,601	0,159	Valid

25	I actively use WhatsApp, and/or WeChat, and/or QQ for learning (in-class discussions, class WAG, accessing materials, etc.)	0,668	0,159	Valid
26	I can create Google forms	0,731	0,159	Valid
27	I can send my assignments or work via Google Forms and/or Google Drive	0,678	0,159	Valid
28	I actively manage Google Drive	0,325	0,159	Valid
29	I prefer to work on assignments via Google Docs rather than Microsoft	0,375	0,159	Valid
30	I can access Baidu to obtain materials	0,603	0,159	Valid
31	I can download Youku to obtain materials	0,518	0,159	Valid
32	I know the limitations of interaction in digital space	0,562	0,159	Valid
33	I know the ethics of searching and providing information in digital space	0,569	0,159	Valid

Table 5. Results of the reliability test

Questions	Variable	Cronbach's Alpha	Reliability	Description
33	students' digital literacy	0,940	Very Strong	Reliable

3.2. Validity Test

The validity test aims to establish that the instrument "Digital Literacy" is valid and can be used for data collection. Validation can be proven through content, construct, and criterion-related validity. Content validity is used to demonstrate the relevance of items to the content, while construct validity measures the clarity of the research framework [17] Rosita et al., (2021). This study employed IBM SPSS Statistic 25 for data processing to test validity. The questionnaire questions are considered valid for data collection if the r-value is greater than the r-table with $\alpha = 0.05$ or at a 5% level. The validity of each questionnaire item is evaluated using the product-moment correlation method, comparing the score of each item with the total score. The results of this validation expert are in line with the results of the [11] Sidauruk (2021) study, which used the same method in developing the Digital Literacy Assessment Scale (DLAS) Instrument to Measure Students' Digital Literacy Skills. All the instrument "Digital Literacy" items compiled have been designed based on the principles of [15] Digital Literacy Across the Curriculum theory so that they comprehensively cover aspects of digital literacy and are by the needs of technology integration in the Mandarin language learning process. Based on the validation test results, questions regarding the digital literacy of Mandarin students are deemed valid. They can be used in research, as the correlation values are more significant than the 5% level, as seen by the 33 questionnaire items showing r-values > r-table. Validation testing is a method to determine how accurate and precise a measuring instrument is [18] Purnomo, (2018). It also aims to identify any statements that should be removed or revised due to irrelevance. Validation is conducted by comparing the r-value with the r-table value. The results are deemed valid if the r-value is greater than the r-table value. The validation criteria are divided into five levels: an r-value of 0.8 to 1 indicates very high validity; 0.6 to 0.799 represents high validity; 0.4 to 0.599 suggests moderately high validity; 0.2 to 0.399 indicates low validity; and an r-value between 0 and 0.199 signifies very low validity or invalidity [19] (Masitha, 2020). This analysis's

results align with the research results of [20] Febliza (2020), the digital literacy instrument developed obtained valid results on all items. The difference is that the results of this study are intended for Mandarin language study program students, while the results of [20] Febliza's (2020) research are designed for students and teachers.

3.3. Test Reliability

The reliability test applied in this study utilizes the internal consistency method, specifically Cronbach's alpha technique. The questionnaire is considered reliable if the Cronbach's alpha value >0.60 [21] Yasmin and Kurniawan, (2011). The researcher used Cronbach's Alpha with the assistance of reliability. The interpretation of the correlation level by Sugiyono (2017) is applied to determine the instrument's Reliability. Cronbach's values ranging from zero one. A Cronbach's alpha value of >0.40-0.60 is considered sufficiently reliable. The table below shows the results of the reliability test. In Table 5, the section on Reliability Statistics indicates that Cronbach's alpha value for the questionnaire items is 0.940 at a 5% significance level, more significant than the r-table (0.6), indicating an extreme level of Reliability. Therefore, the questionnaire is proven to be reliable. This is consistent with the study by [22] Dewi and Sudaryanto (2020), stating that the reliability testing of a research instrument is a test used to determine whether a questionnaire used for data collection is reliable. In the reliability test using Cronbach's Alpha analysis, if the Cronbach's Alpha value is >0.60, it can be concluded that the variable is reliable or consistent in measurement.

4. Conclusion

The results of the validity test by two experts indicate that the "Digital Literacy" instrument used is valid and suitable for use. This result aligns with the validity test results of digital literacy among Mandarin language education students, showing that the "Digital Literacy" instrument used is valid. The questionnaire items can be used as data collection tools in research. The reliability test results with Cronbach's Alpha indicate that the questionnaire is

reliable or consistent in measurement. The descriptive test results of Mandarin students' digital literacy also show that the majority strongly agree and agree with the given statements, with only a tiny percentage expressing disagreement. This means that the instrument is valid and can be used as a measurement digital literacy tool. These results align with [11] Sidauruk's research and the [15] Digital Literacy across the Curriculum theory. The results of developing the "Digital Literacy" Mandarin digital literacy instrument can be implemented realistically with various impacts on various parties. Although the population and sample of this study are university students, this "Digital Literacy" instrument can also be used for Mandarin learners at other educational levels. However, the claim of its effectiveness is based on limited testing. The paper would benefit from a broader testing phase to substantiate these claims more robustly. Further research can be directed to using the instrument in a more extensive scope of research with a broader testing phase. The development of the "Digital Literacy" Mandarin digital literacy instrument can be practically applied in curriculum development by including digital literacy as a core competency, ensuring students have the skills to use technology to learn and communicate in Mandarin. Teachers can use this instrument to design technology-based learning methods in teaching strategies. At the same time, education policymakers can use it as a guide in formulating policies that support the integration of digital literacy in Mandarin language programs in educational institutions.

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Funding Statement

The 2023 Decentralization Fund of the Faculty of Letters, State University of Malang, funds this research.

Acknowledgments

We want to thank all parties who have supported the implementation of this research. The entire research team would like to express their gratitude to all the Mandarin language lecturers and students of the Mandarin Language Education Study Program, State University of Malang, and State University of Surabaya who were involved, as well as the related parties who supported this research so that it could run smoothly and benefit both parties. As the Principal Investigator (PI), AV is responsible for overseeing the overall direction and progress of the research project, coordinating with team members, preparing reports, and ensuring adherence to ethical standards. LUM's role involves identifying and gathering relevant literature and sources, conducting comprehensive reviews, and providing insights based on these findings. KFL is tasked with collecting data at the State University of Malang (UM) campus, ensuring the accuracy and Reliability of the data, and maintaining detailed records. Similarly, MFM handles data collection at the State University of Surabaya (UNESA) campus, ensuring the same level of precision and collaboration with the team. MK's responsibility is to compile and organize the research findings into a coherent manuscript, writing, editing, and revising it to meet publication standards and ensure it adheres to the target journal's guidelines.

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