AFAQ LUGHAWIYYAH
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https://journal.unisza.edu.my/afaq
e-ISSN: 2990-9007

THE EFFECTIVENESS OF DEVELOPMENT OF BRAIN-BASED ARABIC LEARNING MEDIA WITH A NEUROSCIENCE APPROACH TO MUHAMMADIYAH VOCATIONAL HIGH SCHOOL STUDENTS IN THE COVID-19 PERIOD

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Received: 10/9/2024 *Accepted: 11/1/2025* *Published: 31/3/2025*

Abstract

The problem at SMK Muhammadiyah 3 Yogyakarta is that students struggle to understand Arabic due to conventional teaching methods and reliance on textbook-based learning. This approach limits comprehension and engagement. The cause lies in outdated techniques that do not cater to students' individual needs. By integrating neuroscience-based media, the study aimed to improve learning outcomes, resulting in increased comprehension and higher average scores. This approach effectively addressed traditional learning challenges. This study aimed to develop Arabic learning media based on neuroscience in SMK Muhammadiyah 3 Yogyakarta. Neuroscience as the learning media has the goal to improve the students' learning outcomes. The data was obtained from documents and interviews. The results of the classification of reputable National and International journals, as well as interviews, were conducted with 20 students and 2 teachers. The study's result proves that Arabic learning media based on neuroscience could improve the students' learning outcomes in learning Arabic with an average score of 77.58/B+. The combination of attractive learning media and neuroscience theory is an approach that could stimulate students. The analysis of learning media continued based on neuroscience to the stages of product design, development, and evaluation to revision, resulting in data that student learning outcomes were well arranged. The weakness of neuroscience as the Arabic learning media was on the results of the students' population data, only a few students did not understand to improve students' Arabic learning outcomes. Therefore, the development of neuroscience as Arabic learning media required further research, the implications of developing Arabic learning media based on neuroscience could provide creativity to teachers and help the students in learning Arabic, especially in SMK Muhammadiyah 3 Yogyakarta.

***Keywords**: Arabic teaching, Covid-19, Brain-Based Arabic learning media, Neuroscience approach, learning outcomes*

Cite as: Jailani, M. (2025). The effectiveness of development of brain-based Arabic learning media with a neuroscience approach to Muhammadiyah Vocational High School students in the COVID-19 period. *Afaq Lughawiyyah,* *3*(1), 172–190. https://doi.org/10.37231/afaq.2025.3.1.141

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INTRODUCTION

The main problem in this study is that learning Arabic is considered a difficult subject for students at SMK Muhammadiyah 3 Yogyakarta. Hence, the development of Arabic learning media based on neuroscience as a guide to the student's comprehension (Abu-Remaileh, 2021). because the learning activity was not carried out effectively (Alwishah, 2016). As the previous study, there were several researchers have been studying this matter (Booth, 2021).

Besides, Arabic learning was considered overwhelming for the students. This research was based on the argument that students had not been actively participating in the learning activities. The teaching and learning process was conducted using a teacher-centered approach (Dahou et al., 2019). This approach also relied on textbooks or student worksheets. Students were primarily instructed to write, read, and listen to the material explanation. According to the teacher who taught this subject, the teaching method used was still based on conventional teaching practices.

The book used was a textbook from the PWM Educational School (Akzam et al., 2021). The information was obtained in the new academic year of 2021 on February. Based on the preliminary study, students preferred the audio-visual media to textbook in learning Arabic. However, in this case, (Markova, 2021). the media delivered by the teacher was more emphasized with a neuroscience approach (Mohammad Jailani et al., 2021). It means, the audio-visual media had more advantages in developing the students' thinking skill (Ritonga, Kustati, et al., 2021). The pictures in the media were focused on brain stimulation (Al-Khresheh et al., 2020). It implied that the visualization in the media was more focused on the right brain and left-brain approach. It is Arabic learning media which based on neuroscience (Iva Ribero Cota et al, 2018).

Nowadays, Arabic research has big implications for the disciplines of Arabic language and literature (*adab*) as explained in Ritonga's research (2021). There are a lot of discussion about Arabic etiquette or linguistics, (Hamzah et al., 2020) we barely find the discussion on learning matter, especially in Arabic (Ritonga, Widodo, et al., 2021). Most of the research focused primarily on curriculum development and the development of Arabic language materials. Jung-In (2020) described that the development of curriculum every year affected learning that continued to be innovative (Hamid et al., 2021). However, the problem that occurs is that the teacher is not able to be innovative and creative which makes students lack interest in learning (Jung-IN KIm Chair et al, 2020).

Based on relevant research from Fauzi, which was entitled "The Use of Neuroscience for the Development of the Arabic Curriculum", neuroscience approaches the right brain and left brain as stimulation for students to understand Arabic (Fauzi Muhammad Ilfan, 2020). The material stimulation and implementation delivered by the teacher. Hilmi conducted a similar study in his research which explained the importance of implementing neurolinguistics for learning in Islamic boarding school (Xuan et al., 2020). Specifically on learning *quwaid as-sarfiyyah* (Uril Baharuddin et al., 2021). Apparently, the learning technique that was applied in Islamic boarding schools is lecturing technique. In line with Jailani (2021), his research focused on the application of a neurolinguistic approach implemented at Madrasah Aliyah (Islamic High School).It meant that the neurolinguistic approach helped the students to memorize *mufrodat* and practice *muhadasah* because neurolinguistics focuses on how students learn with their brains (Mohammad Jailani et al., 2021).

Based on the perspective of literature art events or previous research survey and a summary of the background and main problems of previous research, some researchers focused on the topic of Arabic with literature (*Adab*). The previous researchers focused on the use of neuroscience in the Arabic curriculum, neuroscience is called neurolinguistics in the learning method approach. Due to the lack of creative media and learning, the learning has been more directed towards conventional techniques (Akmaliyah et al., 2021). Therefore, this research intended to focus on the discussion of Arabic learning media based on neuroscience. The objectives of this research were to develop Arabic learning media based on neuroscience to help the students in understanding Arabic material easier and improving students' learning outcomes (Abdullah, 2014).

Based on the explanation above, the researchers need to use alternative Arabic learning models. The implementation of learning that has been applied in schools is lecturing techniques with textbooks. In the preliminary study, some findings stated that students in SMK Muhammadiyah 3 Yogyakarta had difficulties understanding the Arabic language learning material delivered by the teacher (Teacher, Observation (2021). Unfortunately, there was a lack of appropriate media for learning *qiro'ah*, *kitabah*, *istima'*, and *muhadasah* for students who were unable to read the Qur'an and correctly recognize the letters of Hijaiyah. The Arabic language learning at SMK Muhammadiyah 3 Yogyakarta relied on textbooks and student worksheets (Teachers and Students, 2021). Thus, the focus of this study was the development of Arabic learning media based on neuroscience for the students at SMK Muhammadiyah 3 Yogyakarta.

To enhance the development of brain-based Arabic learning media with neuroscience, the Borg and Gall model serves as a valuable framework. This model involves a systematic process of research and development, including steps such as preliminary research, product development, validation, and testing. By applying this model, the development of Arabic learning media integrates neuroscience principles, focusing on brain stimulation and synchronization between the brain and language acquisition. The Borg and Gall model ensures that the media is effectively tailored to

meet the needs of students, providing a structured approach to enhancing learning outcomes through scientifically-informed strategies.

The Borg and Gall model is well-suited for developing brain-based Arabic learning media with neuroscience, as it provides a comprehensive approach to creating educational products. This model involves a series of stages, including needs assessment, design, development, testing, and revision. By integrating neuroscience principles, such as brain stimulation and cognitive synchronization, into the development process, the media effectively supports students in enhancing their Arabic language skills. Through systematic validation and practical application, the media is refined to ensure it meets both educational and neurological effectiveness, thereby improving student engagement and learning outcomes (M. Jailani, 2022; M. J. Jailani et al., 2023; Walimatul Fara et al., 2021).

LITERATURE REVIEW

The Effectiveness of Development of Brain-Based Arabic Learning Media with a Neuroscience Approach to Muhammadiyah Vocational High School Students in the COVID-19 Period (M. J. Jailani et al., 2023). Neuroscience-based learning approaches emphasize how the brain processes information, making education more effective and aligned with the brain's functions. In Arabic language learning, this approach engages both the right and left hemispheres of the brain to optimize comprehension and application. This concept is rooted in theories supporting the integration of information processing and cognitive stimulation (M. Jailani & Widodo, 2021).

The relevance of neuroscience-based media lies in its ability to enhance student learning outcomes. These media are designed to leverage neuroplasticity, where the brain adapts and learns through specific stimuli. Research shows that this method not only increases engagement but also accelerates understanding compared to traditional methods (Sinaga et al., 2024).

The COVID-19 pandemic presented new challenges to education, including Arabic language instruction. Online learning often lacks interactivity, creating a need for media capable of addressing these limitations. Neuroscience approaches provide effective solutions for remote education, ensuring continuity in learning (Kerras & Essayahi, 2022; Leech et al., 2022).

Arabic language learning includes four key skills: reading (qiro'ah), writing (kitabah), listening (istima'), and speaking (kalam). Neuroscience-based learning media aim to develop these skills through an integrated and comprehensive approach. This method enhances students' ability to master Arabic holistically and effectively. Ibn Sina's multilevel reasoning principle emphasizes gradual and systematic understanding, progressing from memorization to practical application. This concept aligns with neuroscience-based media, supporting a step-by-step learning process that ensures deeper comprehension of Arabic material (M. J. Jailani et al., 2023; Mohamad Jailani, 2023).

Studies on Arabic learning media highlight the importance of innovation in education. Research suggests that incorporating neuroscience principles into educational tools can address the limitations of traditional Arabic instruction. Such media foster better engagement and learning outcomes. Despite its effectiveness, neuroscience-based media have certain limitations, including the need for proper teacher training. Without adequate preparation, educators may struggle to utilize these tools to their full potential. Continuous professional development is crucial to address this challenge (M. J. Jailani et al., 2023).

Motivation plays a significant role in Arabic language learning. Neuroscience-based learning media not only improve understanding but also enhance motivation by providing engaging and interactive methods. This dual benefit is key to fostering sustained student interest. The implications of neuroscience-based media in Arabic education are profound. This approach has the potential to revolutionize Arabic learning, particularly during unprecedented times like the COVID-19 pandemic. Further research and development are recommended to refine these tools and maximize their impact on the future of Arabic education (Eltahir et al., 2021; M. J. Jailani et al., 2023; Mohamad Jailani, 2023).

METHODOLOGY

This research was conducted in SMK Muhammadiyah 3 Yogyakarta, researchers chose SMK Muhammadiyah 3 Yogyakarta as the place of the research because it met the requirements and research criteria. In this study, the research subjects were three teachers and twenty students. From these two research subjects, it is expected to obtain complete data regarding Arabic learning media based on neuroscience in understanding, memorizing, and practicing Arabic *mufrodat* and *muhadasah*. Determination of research subjects is done by sampling the data source. The research analysis was to develop Arabic learning media based on neuroscience. Moreover, the students in SMK Muhammadiyah 3 Yogyakarta have not been able to understand the material delivered by the teacher.

The confirmation of this type of research used was R&D (Research and Development) with Borg and Gall model. At the initial planning stage, the researchers used methods and approaches related to primary and secondary data. Primary data were obtained through scientific journals, both National and International journals from Google Scholar. Researchers classified the relevant journal articles, to select and choose those that were suitable as primary data references. The secondary data was obtained in SMK Muhammadiyah 3 Yogyakarta through a questionnaire/questionnaire method, interviews, observation, and documentation guidelines.

The development procedure in this study is based on the procedural steps presented by Borg and Gall which consisted of ten stages. However, at this stage, the researcher only applied five of the 10 stages in this development research. These steps are as follows : 1. Research and initial information gathering stage, 2. Planning stage,

3. Product format development stage, 4. Testing stage with product validation, 5. Product revision stage (Darmalaksana, 2020).

Data collection techniques were carried out by using interview, observation, and documentation methods. First, in-depth interviews were guided by the interview guide. The interview was the primary data in this study. The interview was intended to obtain data by asking questions about everything to informants regarding Arabic learning media based on neuroscience in understanding, memorizing, and practicing Arabic language *mufrodat* and *muhadasah* in SMK Muhammadiyah 3 Yogyakarta. The informants were the teachers and students. Second, observation was conducted to obtain information about Arabic learning media based on neuroscience in SMK Muhammadiyah 3 Yogyakarta. Observations to be carried out are formal or informal. Third, the method of documentation. The documents to be studied are textual data and photos of Arabic learning media in SMK Muhammadiyah 3 Yogyakarta. The textual data were textbooks, student worksheets, educator administration, and learning curriculum related to Arabic learning media. Meanwhile, photo and recording documents provided visual information about the practical activities of Arabic learning media based on neuroscience in SMK Muhammadiyah 3 Yogyakarta.

In this study, the type of data analysis used was Miles and Huberman (1994) model. It was done if the activities in qualitative data analysis were carried out interactively and taken place continuously until complete so that the data was saturated. Activities in data analysis were data reduction, data display, and conclusion drawing/verification data. Three main interrelated activities occur simultaneously, namely: data reduction, data display, and conclusion drawing or data verification. Meanwhile, the test was used to know the effectiveness of the test section on student learning outcomes.

RESULTS AND DISCUSSION

FINDINGS

Based on the informant's data, SMK Muhammadiyah 3 Yogyakarta is an education that concentrates on the field of skills automatically learning that is emphasized is a practice rather than theory development. The learning process in SMK Muhammadiyah 3 Yogyakarta is based on a textbook. Teachers only rely on textbooks to deliver material to students (Setiawan, 2021). The following table is the data of Arabic scores in 2020:

Table. 1 Student Learning Outcomes Before Using Neuroscience Media

No	Learners	Learning outcomes	Scores	Factor
1	H N	Below standard score	65	Not able to understand the material
2	J R	Below standard score	70	Not able to understand the material

3	ML	Below standard score	65	Not able to understand the material
4	S H	Below standard score	70	Not able to understand the material
5	F Q	Below standard score	65	Not able to understand the material
6	F Z	Below standard score	70	Not able to understand the material
7	I N	Below standard score	65	Not able to understand the material

The table above is a sample of student learning outcomes in the academic year of 2020 through data from the teachers in SMK Muhammadiyah 3 Yogyakarta. The data focused on Grade 10 in computer network engineering major. Of the 20 students, all students had difficulties in learning Arabic before using Arabic learning media based on neuroscience. The result of the interview is as follows:

According to a confession from a student: "Sir, Arabic is pretty difficult to understand and read, especially memorizing and practicing Arabic *mufrodat.* The teacher only told us to write without any other way and alternatives" Then, we feel that we are not attracted to learning Arabic in the class, some of our friends can read and write quite well, but cannot practice it."

This is the result of student interviews with researchers. The students experienced difficulties in understanding the material presented by students (Students, Interview (2021).

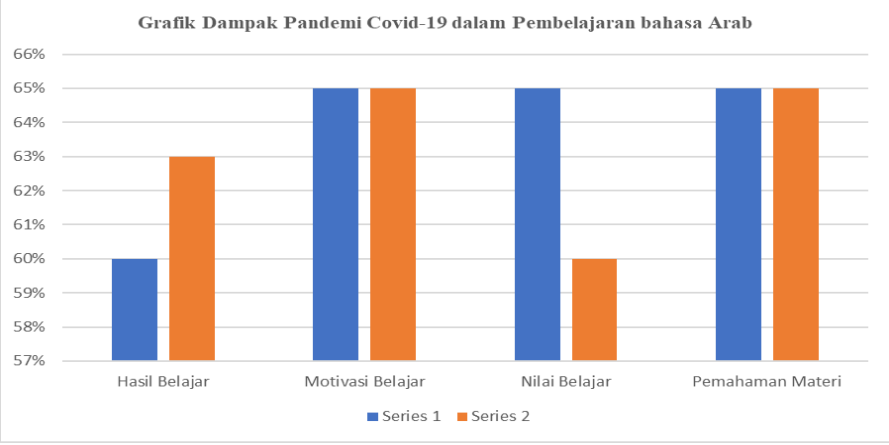


Figure 1. Graph of COVID-19 impacts on the learning process

COVID-19 has made teachers and students carry out teaching and learning activities separately. On the one hand, there are appeals from the government including maintaining social distancing, wearing masks, washing hands, and prohibiting crowds. Teaching and learning activities in the schools had become online learning (distance learning) (Suyadi, Zalik Nuryana, and Niki Alma Febriana Fauzi, 2020). The learning activities are still carried out despite the COVID-19 pandemic. Teachers and students felt difficult and burdened due to online learning activities (Al-Khresheh et al., 2020).

Table 2. Materials validation results

Validator	Maximum score	Rating result	percentage
1	40	46	86%
2	40	45	85%
Total	80	91	87%

The acquisition percentage is 87% which means feasible. It can be concluded that the material in the Arabic learning media developed is very feasible. However, there are some inputs or suggestions given by validators or material experts suggest that it is necessary to add examples of sentences in *mufrodat* topics (the use of vocabulary) and an evaluation model.

In the media validation instrument, there are 8 points of assessment indicators, namely (1) a simple application display; (2) an attractive appearance; (3) easy to read and has good contrast; (4) navigation buttons work well: (5) well-operated audio; (6) easy to use; (7) the application can be used without any problems; (8) application is not an error. Each item statement means 1 as the lowest and 5 as the highest score.

Table 3. Media validation results

Validator	Maximum Value	Rating result	Percentage
1	50	48	93%
2	50	47	91.4%
Total	100	95	92.24%

The results of the validation indicated that the Arabic learning media based on neuroscience developed for this study met the very feasible criteria, with a percentage of approximately 92.24%. However, there were some suggestions from validators or media experts to optimize the teaching media, such as increasing the font size in the Arabic learning media based on neuroscience.

Table 4. Final Results after the Use of Media

No.	Students	Media Development Implementation Results	Average score	Likert scale
1	20 students	Test 1	76.2/B+	Results obtained 89 of 1-100
2	20 students	Test 2	80.15/A	90/100 from 1-100

The results of the tabulation above explain that after the use of Arabic learning media based on neuroscience was conducted 7 times, students were given tests to determine student learning outcomes and to find out the improvement of their Arabic ability by using Arabic learning media based on neuroscience. The results of the first test showed that the average test score of students was 76.2/B+ on a scale of 1-100 with a range of scores between 49-89. These results indicated a good interpretation. 20 students were tested in the Arabic learning process.

Based on the test results, it can be concluded that neuroscience-based Arabic learning media can improve student learning outcomes. This is evident from the fact that the average score in Test 1 was 76.02 (B+), which increased to 80.15 (A) in Test 2, reflecting an improvement of 3.13 points. The average learning outcome for Test 2 was 77.58 (B+). According to the research criteria, an average score of B+ (74-78) on a scale of 1-188 is considered very good. Then, the test results had exceeded the number of criteria. In other words, the teaching materials developed can improve student learning outcomes.

Table 5. Improvement of Arabic Learning outcomes after using Arabic learning media based on neuroscience in 2021

No.	Learners	Score	Improved Learning
1	M Z	75	Mastering and memorizing *mufrodat*
2	A G	80	Mastering, writing and *imla'*
3	P P	79	Understanding *muhadasah* easier
4	S M	80	Fluent in speaking *mufrodat*
5	H S D	75	Memorizing *mufrodat*
6	S J	80	Memorizing *mufrodat*
7	D M Y	75	Memorizing *Mufrodat*

8	R U	80	Memorizing *mufrodat*
9	I R	85	Memorizing *Mufrodat* and able to pronounce it.

Twenty samples for the research were taken from students at SMK Muhammadiyah 3 Yogyakarta, with assistance from the Arabic teachers. The students submitted the results of the questionnaire by the concepts and ways of learning expected by students. Students were assisted and facilitated the learning process which related to *muhadasah* material, *mufrodat*, and practice of working on questions and exercises in learning media (Students, Questionnaire, 2021).

DISCUSSION

Implementation of Arabic Learning Media Based on Neuroscience Development in COVID-19 Outbreak

During COVID-19 outbreak, Arabic learning has been neglected, even though not only one school or two schools have been affected. In general, in 2020, all teaching and learning processes are conducted from home by online learning (Shearer, 2020). The most important and crucial activity in education is the approach to learning between teachers and students such as the communication and interaction between teacher and students (Andrews, Walter, and Ayse Dalyan, 2020). The following is a description of learning media during the COVID-19 pandemic:



Figure 2. Teaching and Learning Process with Online Learning Media (Teachers, Documentation, 2021).

The figure above shows how a teaching and learning process was carried out in SMK Muhammadiyah 3 Yogyakarta during the COVID-19 pandemic. It means that students were provided the material from the teacher through the learning media. The teacher also provided exercises for Arabic subjects and combined them with Arabic learning (Yana et al., 2020). Based on the evidence, the learning process was merely based on the textbook. Then, the students would have the difficulties to comprehend and understand the material presented by the teacher (Yoyo, 2018).

Implications of Development of Arabic Learning Media Based on Neuroscience

Neuroscience is a neural science that studies the nervous system, especially studying neurons or nerve cells, with a multidisciplinary approach (Mohammad Jailani et al, 2021). Neuroscience is a field of science that specializes in the scientific study of the nervous system (Boudelaa et al., 2010). Therefore, neuroscience is also called the study of the brain and all the functions of the spinal core (Davis et al., 2020). The following is descriptive neuroscience in learning:

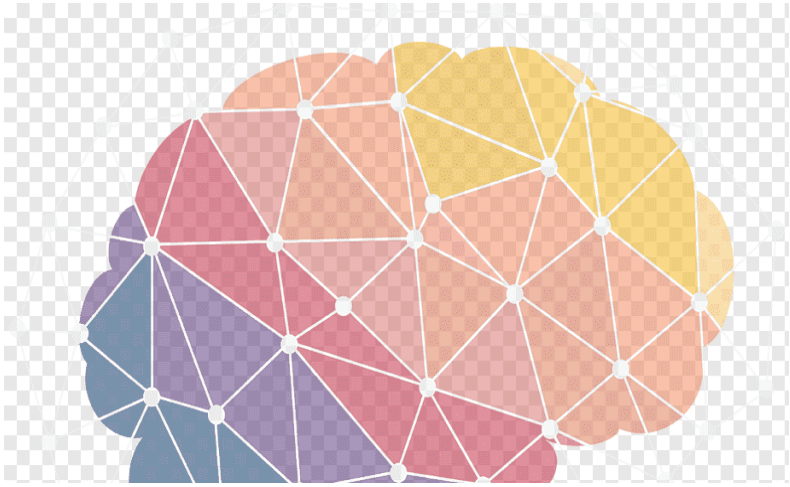


Figure 3. Neuroscience and Teaching Media (Riska Yuli Nurvhianti, 2018).

Considering that learning media has been improved a lot, Arabic learning media based on neuroscience emerged (Pesenti et al., 2021)· Neuroscience is a facilitator for the student's interest in language learning (Rahmat Ryadhush Shalihin et al., 2021). The power of thinking that is focused and enjoyable, affects the brain (Perkins et al., 2019). Besides, the part of the brain that responds to the task of developing information and optimizing the brain is the prefrontal cortex (Belkacem & Lakas, 2021)· This part serves to send brain nerve cells to the right brain and left brain (Atoum & Nouman, 2019)·

The development of Arabic learning media based on neuroscience is carried out in several stages as stated above. Stage 1. Analysis, Stage 2. Design, Stage 3. Development, Stage 4. Evaluation (Test), Stage 5. Revision. Among 10 stages of

development, researchers only carried out 5 stages in the process of developing Arabic learning media based on neuroscience as follows:

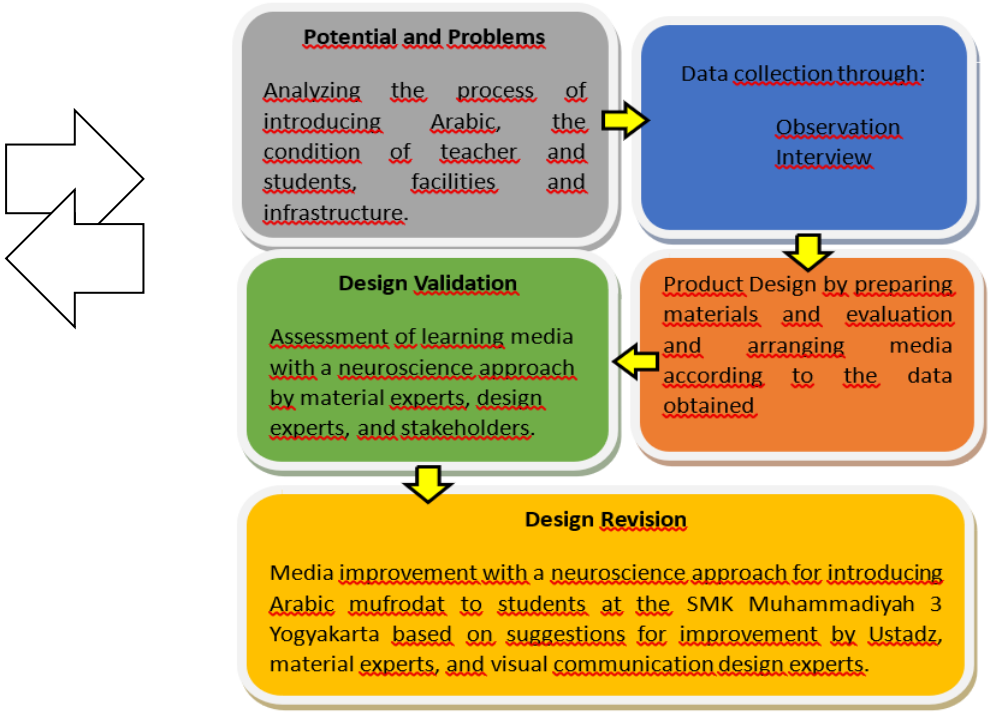


Figure 4. The research stages

In the early stages, students' needs analysis was carried out by documentation, observation, and interviews (Zaini et al., 2021). The material was adapted from the basic competencies and indicators of learning objectives (Yoyo, 2018). Materials contained the discussion of *mufrodat* and *muhadasah* by focusing students on maximizing the right-brain and left-brain approaches, the teacher continued to identify them.

The content of the learning chapter material delivered to students in SMK Muhammadiyah 3 Yogyakarta based on the basic competencies in the Arabic language textbook by the Team of the Directorate General of Primary and Secondary Education for Regional Leaders of Muhammadiyah Yogyakarta (McCracken, 2024). The researcher gave materials with attractive PowerPoint slides (Schiller, 2020). This research was on Arabic learning media based on neuroscience (Rachel I. Mayberry et al., 2017). See the image below:



Figure: 5. Arabic Learning Materials.

The description of the material above is a lesson delivered by the teacher to the students (Pimada et al., 2020). The chapter on *assyakanu* (*tempat tinggal* / residence) (Amrulloh et al., 2021). In this stage, the students were taught about *maharah qiro'ah* (reading), *maharah istima'* (listening), *maharah kitabah* (writing) and *imla'*, and finally they are expected to be able to practice *maharah kalam* (speaking) (Li et al., 2022). Certainly, the teacher was a facilitator and made an easier Arabic learning for students (Fithrotul Jannah et al., 2018).

The steps in Arabic learning media based on neuroscience are as follows:

1. Students operate audio-visual videos that is given (shared) by the teacher.
2. Students read the text delivered by the teacher in the media
3. Students listen to the audio
4. Students concentrate on their brains and respond with the language to be spoken
5. Students see, listen, and practice what the teacher says in the media.
6. The teacher identifies students who is able and not able to read the vocabulary (*mufrodat*)
7. Finally, students read and practice together with the teacher.

Based on the results and discussion above, the exact problem in SMK Muhammadiyah 3 Yogyakarta was the lack of creative and innovative Arabic learning media. Teachers might not be able to initiate and create the learning media and materials which meet students' expectation. Hence, students could not understand the material presented by the teacher. Therefore, the contribution of this research complemented and provided an alternative way specifically for learning media. The contribution was Arabic learning media based on neuroscience. This media is enjoyable and easy to access by directing the use of the right brain and left brain of

students. It is relevant to the case in SMK Muhammadiyah 3 Yogyakarta related to Arabic learning.

CONCLUSSION

Based on the findings and discussion, it can be concluded that Arabic learning in SMK Muhammadiyah 3 Yogyakarta is diverse. The implementation of Arabic learning media based on neuroscience development significantly improved students' learning outcomes, with an average score of 77.58 (B+), and enhanced their motivation. This media facilitated the improvement of students' language skills, including *qiro'ah, kitabah, istima'*, and *kalam*, by leveraging right-brain and left-brain approaches to optimize language comprehension. However, the study had certain limitations, particularly in the content and depth of the neuroscience-based media. The materials and visualizations applied still require refinement to maximize their impact on students' learning outcomes. Further research is necessary to address these gaps and produce a more comprehensive understanding of neuroscience-based Arabic learning.

To strengthen the implications of this study, actionable recommendations are proposed for educators and policymakers. Educators should integrate neuroscience-based approaches into their teaching methods by incorporating brain-based strategies and innovative media tailored to Arabic language instruction. Policymakers are encouraged to support professional development programs that train teachers in neuroscience-based pedagogy, equipping them with the skills to utilize such media effectively. Moreover, policymakers could facilitate the development of a neuroscience-based curriculum for Arabic learning, emphasizing interactive and visual content to cater to diverse learning needs. Continuous monitoring and evaluation of these methods are essential to ensure sustainable improvements in students' language proficiency. By adopting these strategies, educators and policymakers can foster a more effective and engaging Arabic learning environment, contributing to the broader advancement of Arabic education.

CONFLICTS OF INTEREST: The authors declare that they have no conflicts of interest.

ETHICS STATEMENT: This study was conducted in accordance with ethical principles and academic integrity. All procedures were carried out responsibly, with informed consent obtained from participants and strict confidentiality maintained.

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