

# Development of Anato-Smart Media as an Interactive Learning Media for Elementary School Students Regarding Limb Anatomy



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## ABSTRACT

The subject matter of science, especially related to human anatomy, is one of the most challenging to understand. To help understand science materials, especially human body anatomy, we conducted community service by developing the Anato-Smart book as a learning media for students and teachers of 5<sup>th</sup> grade of Muhammadiyah 1 Elementary School Surakarta in 2021. The method of implementation in this service was implemented for five months, including several stages. The first stage was determining the topic of the body system for the learning media that would be developed through the Focus Group Discussion for 13 teachers at Muhammadiyah 1 Elementary School Surakarta, then followed by the development of interactive and educational story media Anato-Smart with the title "The Adventures of Andi and Si Balung". The media was piloted to 50 students of 5<sup>th</sup> grade at Muhammadiyah 1 Elementary School Surakarta and evaluated by interviewing and distributing questionnaires to teachers. This service activity resulted in an Anato-Smart teaching media developed to hone the students' analytical skills on limb and skeletal topics. Teachers can use this book to augment interactive lessons and as an educational resource for students to learn about potential risks and disorders to the limbs and skeleton in daily life. The questionnaires and FGD's data were analyzed descriptively, quantitatively and qualitatively. This book's story and education concepts are intriguing and facilitate comprehension; however, it is better to lessen the words and increase the number of images to make it more interesting for children. We will use this feedback to improve the final results of this media so that it can be used by other schools, not only by Muhammadiyah 1 Elementary School Surakarta. Collaboration with other parties to develop teaching media in the future is needed to produce educational and interactive teaching media.

**Keywords:** Anatomy; elementary school science; limb and skeleton, anato-smart, learning media.

**Cite This Article:** Maftuhah, A., Kakanita, H.B., Laras, A.A., Nugroho, D., Poncoroni, P.E., Ika, B.V., Maryani., Eralusi, N., Dasa, R.A. 2023. Development of Anato-Smart Media as an Interactive Learning Media for Elementary School Students Regarding Limb Anatomy. *Journal of Community Empowerment for Health* 6(3): 176-182. DOI: 10.22146/jcoemph.88937

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Submitted: 2023-09-13

Revised: 2023-11-01

Accepted: 2023-12-11

## INTRODUCTION

Anatomy is one of the basic sciences of medicine that must be studied and understood. The learning scope of anatomy is about the human body structures that contain cells, tissues, organs, and organ systems. Each organ of the human body has a specific structure and function, but all organ systems are interrelated. The organ systems studied in the anatomy of the human body are numerous, including the skeletal system, musculoskeletal system, cardiovascular system, digestive system, nervous system, endocrine system, respiratory system, integumentary system, reproductive system, and other systems.

The elementary school curriculum in 2021 used integrative thematic learning of the 2013 curriculum that combines aspects

of knowledge, skills, and attitudes as a whole.<sup>1</sup> Within the scope of this integrative thematic curriculum, some of them teach about the five sense organs, organs of motion which include the skeletal system and muscular system, digestive organs, respiratory organs, and circulatory organs, which are part of the thematic subjects of science 4<sup>th</sup> to 5<sup>th</sup> grade.<sup>2</sup> This demonstrates that human anatomy has begun to be studied since elementary school, although not too complex compared with medical anatomy. Still, anatomical content and language are challenging for elementary school students to memorize.

There are undoubtedly obstacles in teaching elementary school students about human anatomy. One of them is the difficulty experienced by some teachers in developing effective and efficient learning

media and materials for students.<sup>1</sup> Intriguing and fun learning media will be a motivation, particularly for elementary school students, to study and comprehend the human body's anatomy.<sup>3</sup> It is hoped that the correct media will help students understand the anatomy of the human body more clearly so that they do not just memorize abstract anatomy material.

Learning is a process of interaction between teachers and their students by using learning resources to exchange information in an academic environment. During this service, teaching and learning in elementary schools used curriculum K-13, which has been implemented by the Indonesian Ministry of Education, Culture, Research and Technology since the academic year 2013/2014. In the curriculum K-13 guidance, it is explained

that the government does not regulate learning in detail. Technically, it only sets learning principles, and teachers are expected to be able to carry out meaningful learning so that students are more creative and think critically and innovatively. The implementation of learning is designed to provide a quality and interactive learning experience and contextual learning. Learning is held in an interactive, inspiring, fun, and challenging manner, motivating students to participate actively and providing sufficient space for initiative, creativity, and independence according to students' talents, interests and physical and psychological development.<sup>4</sup>

Based on the initial Focus Group Discussion (FGD) results with 4<sup>th</sup> and 5<sup>th</sup> grade teachers of Muhammadiyah 1 Elementary School Surakarta, the teachers teach based on the Indonesian Ministry of Education teaching module. They also learn from *YouTube* to obtain more information and better understanding. However, there may be teaching content that sometimes made them less confident whether their understanding was correct. Considering this, they expected that having medical professionals convey the information would make it more intelligible and accurate. Besides, the existing teaching media needs to be refined by the children's learning characteristics. In addition, elementary school students still did not understand the dangers that would occur to the limbs associated with the children's daily activities, such as playing or joking with friends that cause falls, collisions, or fractures, which made the teachers of Muhammadiyah 1 Elementary School expected the content adds educational points related to the anatomy of the organs taught that applicable to the daily lives of the students. The purpose of education is to direct students towards changes in behavior both intellectually, morally, and socially so that later, they are expected to live independently as individuals and social beings.<sup>5</sup> Therefore, learning aids or teaching media can achieve effective learning. Learning involves the interaction of various components between learners, teachers, methods, curriculum, facilities, and environmental aspects related to achieving learning competencies.<sup>5</sup>

Due to several issues, elementary

school students had trouble learning science. These issues included difficulty in understanding the material because of a lack of adequate media, the need for students to memorize numerous foreign words found in the science curriculum, and the teachers' factors on the teaching approach and the lack of mastery of science material taught to students.<sup>6</sup> Therefore, the role of teachers is one of the most crucial things in ensuring that the students understand the material. The more coherent learning media surely can help teachers deliver the proper understanding and confidence for teachers in teaching. Media usage in learning can make it easier for students to understand something abstract to be more realistic so that the real learning experience can be a meaningful experience for students.<sup>7</sup>

Based on the analysis of the situation above, the proposers and partners agreed to raise issues about learning human anatomy through the thematic integrative curriculum of a 5<sup>th</sup> grade elementary school. The priority of the problem is the necessity to develop suitable anatomy learning media to assist 5<sup>th</sup> grade elementary school teachers in delivering human body anatomy material to their students by inserting applicable education in the development of learning media. The developed media was named Anato-Smart.

## METHOD

This service activity was carried out in Muhammadiyah 1 Elementary School Surakarta for eight months from March to October 2021 and conducted in several stages that implemented the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model related to learning media development.<sup>8</sup> The stages of ADDIE in this activity include: 1) determining which target anatomy topic for the learning media to be developed through one day FGD problem analysis with 13 teachers of Muhammadiyah 1 Elementary School Surakarta; 2) designing and developing anatomy learning media (Anato-Smart book) by established concepts for 4 months; 3) one-day pilot implementation of the Anato-Smart book for 50 students of 5<sup>th</sup> grades Muhammadiyah 1 Elementary School by

all member of authors and 3 teachers; 4) evaluation of program implementation to teachers of Muhammadiyah 1 Elementary School who were involved in this activity in the end. All authors are involved in all phases of this community service. To evaluate this program, we conducted FGD and distributed questionnaires to teachers. There were 13 teachers as FGD participants and 25 teachers filled in questionnaires. The evaluation aimed to explore the applicability, and then the findings would provide feedback and recommendations for enhancing the media created to sustain the program so the partners can use it as a teaching medium in the future. Data from the FGD and questionnaires were analyzed quantitatively and qualitatively in a descriptive manner.

## RESULT

Anato-Smart media is an interactive book designed to provide anatomical material followed by education regarding the body parts discussed. This book was developed by all authors consisting of medical education experts because anatomy content is the basic medical science that doctors must master. The book also includes several pictures and videos that teachers and students can access.

In the initial stage, FGD was conducted with 13 teachers to analyze the situation and decide on target topics for developing book media. Based on the results of the FGD of Anato-Smart media development with teachers of Muhammadiyah 1 Elementary School Surakarta, we agreed that the target of the elementary anatomy topic to be developed as a learning medium was limb and skeletal organs. The consideration was that the topic was in the curriculum of 1<sup>st</sup> semester of 5<sup>th</sup> grade, so it matched the time of service implementation.

According to the discussion results, students still had some difficulties, and teachers sometimes lacked confidence in whether their teaching was correct. In addition, elementary school students often do not listen to their teachers' warnings when students play excessively, which could endanger their friends. Regarding the teachers' expectation to include relevant education in the media development material, the service team

**Table 1. The storyboard concept of Anato-Smart**

Book Title	The Adventures of Andi and Si Balung
Introduction	Introduction story of Andi, whom his mother warned for not wearing safety gear while skating, later falling asleep and dreaming of encountering Si Balung. Balung was sad that his brothers were injured and took Andi on an adventure to various locations where there may be risks to the limbs and skeleton.
Floor Plan	The concept of playing in various locations of the incident
1 <sup>st</sup> Story	Location: Parking lot. Incident: Foot tripped due to being too busy staring at the mobile phone without looking around. Material: The bones of lower limbs and their functions, video of the foot bones (via link). Education: When walking, you should not use your cell phone or play games to avoid tripping or bumping into something. Quiz: Mention the names of lower limbs bones and their functions.
2 <sup>nd</sup> Story	Location: Playground. Incident: Wrist pain from falling from a swing that too strong and fast. Material: the bones that make up the upper limbs and their functions. Education: First aid steps for injury and not recommended massage to the masseur when experiencing injury. Quiz: Name the bones that make up the upper limbs.
3 <sup>rd</sup> Story	Location: Highway. Incident: Traffic accident due to the sudden need to brake, causing the car's steering wheel to strike the driver's chest. Material: The bones that make up the chest cavity and their functions. Education: Play carefully with friends so as not to kick or hit the chest Quiz: Find the correct bones of the chest cavity between the three figures and explain why.
4 <sup>th</sup> Story	Location: Classroom. Incident: Someone joked by pulling their friend's chair from behind, so they friend fell. Material: the bones that make up the pelvis and their functions. Education: Be careful when joking with friends so no one gets injured. Quiz: Putting together a pelvic bone picture puzzle.
5 <sup>th</sup> Story	Location: Playground. Incident: Playing online games in a bent sitting position for a long time. Material: Spine and its functions. Education: Have the habit of sitting in the correct position. Quiz: Name the backbone.
6 <sup>th</sup> Story	Location: Street in front of the House Incident: Hit the head due to a powerful collision while skating without protection gear for the elbow, knee, and head. Material: Skull bones and their functions, videos of Skull Bones (via link). Education: The importance of wearing a helmet as a protective device when riding a motorcycle, bicycle, or rollerblading. Quiz: Guess the correct skull bones.
Practice Questions	Example questions to recall the overall understanding of the material.
Closure	Awareness to keep yourself safe.

works to create Anato-Smart science learning media that teachers can use as their guide to interactively lead the students through a story about children's daily lives that includes materials related to limb and skeletal science. With the development of this book, it was also expected that it would be possible to enhance students' analytical abilities regarding the acquired knowledge and its application in daily life.

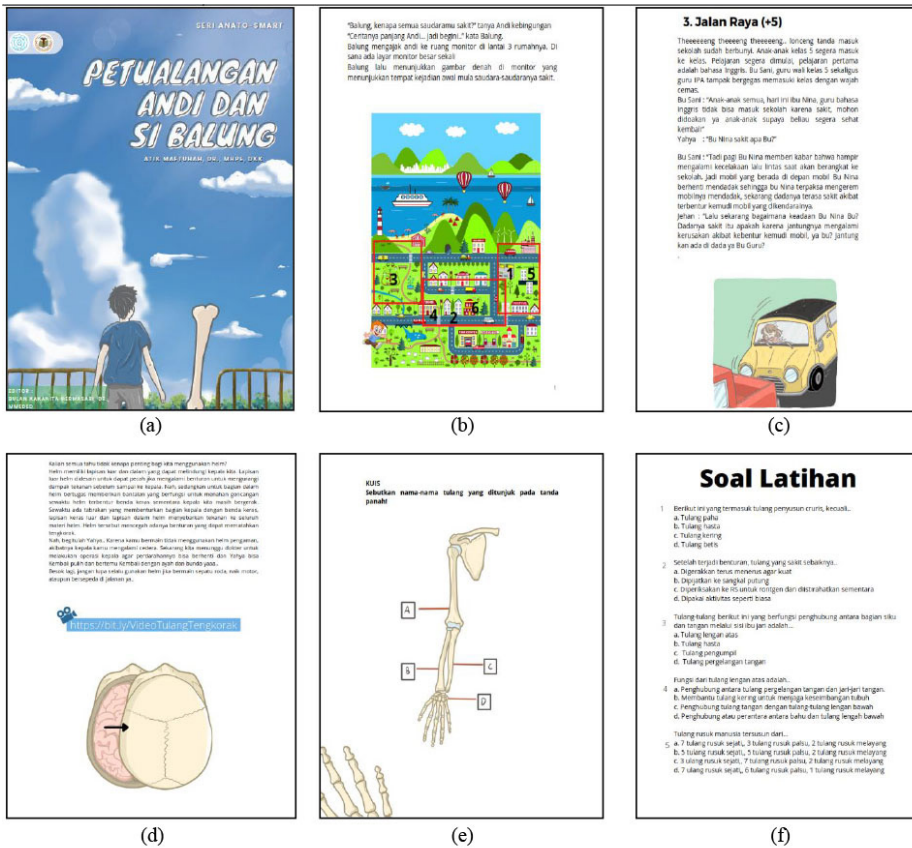
The terms taught in the science material use a foreign language (Latin), which is very common in anatomy subjects for medical and has to be memorized. In elementary school science subjects, these terms are also given in Indonesian for the names of bones in the skeletal system.

Therefore, we developed this Anato-Smart to fulfill the purpose of service, helping 5<sup>th</sup> grade teachers of Muhammadiyah 1 Elementary School Surakarta by providing storybook supplements that can be used as a media in interactive learning with the theme of limbs and skeletal bones. The concept of this book was to contain stories about children's daily lives associated with the possible dangers that can occur in the limbs and skeletal bones so that it would help children analyze the risks they could face in real life as well as learn what makes up the limbs and skeletal bones through plot stories that can occur in real life.

Story material was developed from learning materials about the limb and

skeletal system that are part of the 5<sup>th</sup> grade elementary school curriculum. The development of Anato-Smart media began by creating a storyboard concept of an educational storybook that contains learning materials on the human limb and skeletal system, as seen in Table 1. Anato-Smart storybook is titled "The Adventures of Andi and Si Balung". This book describes the everyday occurrences relevant to the bones' construction and role in the skeletal system of the human body. It also includes information for students about potential risks associated with limbs and bones. The quiz is given at the end of each story as a game so students do not get bored, which still benefits them.





**Figure 1.** The design of Anoto-Smart book. (a) Cover. (b) Map of the location. (c) Incident related to the limb and skeletal system. (d) Video link to additional material. (e) Quiz. (f). Practice Questions.



**Figure 2.** Screenshot of the video as additional material from the hyperlink in the book.

We used Canva design to create layouts and images for this book. Based on the development of storyboards that have been designed, we added bone X-ray images to the content obtained from one of the Radiology Specialists of the Universitas

Sebelas Maret (UNS) Hospital, and there were several videos from the anatomy department of UNS Medical Faculty. The addition of this video was an effort to help students understand the original appearance of the bones and to prevent

children from becoming overly exposed to or bored with storytelling and text. The video screenshots included as an addition to the material can be seen in Figure 2.

The service team was testing Anoto-smart media on 50 students of 5<sup>th</sup> graders of Muhammadiyah Elementary School. Before learning using developed media, the students did a pretest about the limb and skeletal system that had been taught in school. It turns out that more than 80% of students do not remember the material, and initially, they have difficulty integrating the theory with interrelated daily events told through stories in media books. After the implementation trial of the book media by the service team, it can be concluded that the developed storyline in the Anoto-Smart book could help students understand the dangers that occur in limbs and skeletal bones if they are less careful when playing or not using personal protective equipment when driving, for example.

Anoto-Smart media development was evaluated through interviews with science teachers at Muhammadiyah 1 Elementary School Surakarta and the distribution of evaluation questionnaires through the WhatsApp application for teachers who could not attend the interviews by attaching soft files of the book “The Adventures of Andi and Si Balung” to be read first before the teachers filled out evaluation questionnaires. Based on the evaluation, the Anoto-Smart book entitled “The Adventure of Andi and Si Balung” had several advantages and disadvantages that might be observed in Table 2 and Table 3.

Anoto-Smart’s benefits include collaborating text-learning media in the form of concrete stories, accompanied by additional images and videos for students’ direct observation, and expected to attract students’ interest. The aim was that in the future, teachers can encourage students to develop their potential thinking skills through teacher interaction and explanation based on familiar and realistic stories in the Anoto-Smart book. In addition, in terms of material content, according to one of the teachers, the material in this Anoto-Smart book is broader than the limb and skeletal topic in the 5<sup>th</sup> grade curriculum material, so this

book can be an additional supplementary book for learning the limb and skeletal system.

## DISCUSSION

The concept of Anato-Smart media was designed in the form of interactive

storybooks that included educational content on the theme of limb and skeletal system science subject matter. Learning media is suitable as a tool in the teaching

**Table 2.** Evaluation of Anato-Smart book from the questionnaire

Indicators	Evaluation				
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. Easy to use	6 (50%)	3 (25%)	3 (25%)	0 (0%)	0 (0%)
2. Attractive	7 (58.3%)	3 (25%)	2 (16.7%)	0 (0%)	0 (0%)
3. Easy to understand	5 (41.7%)	5 (41.7%)	2 (16.7%)	0 (0%)	0 (0%)
4. Easy to recall	6 (50%)	2 (16.7%)	4 (33.3%)	0 (0%)	0 (0%)
5. Knowledge gained after reading the book Anato-Smart	8 (66.7%)	3 (25%)	1 (8.3%)	0 (0%)	0 (0%)
6. Stimulated students' analytical skills to implement school's subject in everyday life	7 (58.3%)	3 (25%)	2 (16.7%)	0 (0%)	0 (0%)
7. The content of the book could educate the students about the daily event	7 (58.3%)	4 (33.3%)	1 (8.3%)	0 (0%)	0 (0%)
8. The addition of videos and images made it easier for students to understand the material	9 (75%)	2 (16.7%)	1 (8.3%)	0 (0%)	0 (0%)
9. The quiz in the book was interesting	6 (50%)	3 (25%)	3 (25%)	0 (0%)	0 (0%)
10. The quiz in the book varied	5 (41.7%)	5 (41.7%)	2 (16.7%)	0 (0%)	0 (0%)
11. The quiz in the book could assess the knowledge of students related to the limb and skeletal system	7 (58.3%)	3 (25%)	2 (16.7%)	0 (0%)	0 (0%)
12. This book could be used as a teaching supplement in schools	5 (41.7%)	6 (50%)	1 (8.3%)	0 (0%)	0 (0%)

**Table 3.** Teachers' perceptions of the Anato-Smart media

Themes	Sub-themes	Quotations
Advantages	Material content	"This book is interesting because the format is easy to read for children. There is a lot of material, but it doesn't feel overwhelming. For the material, I think it is broader than the material in the 5 <sup>th</sup> grade learning curriculum about the organs of motion. So maybe this book can later be used as an additional supplement." (T-2)
	Usefulness	"Good, can be used by teachers as a reference, very useful in helping teachers to more easily explain the parts of human bones and their uses..." (T-3)
	Languages	"...the language is easy to understand, and the pictures can represent the story." (T-3)
	Contextual	"This book is good because it presents more detailed material about human locomotion with a presentation that is adapted to everyday life. Very helpful for the development of science and knowledge of children, and very interesting insights". (T-1) "The book is good, the material is complete and interesting, it has also been linked to children's daily applications so it will be easier to understand". (T-5)
Disadvantages	Illustration and animation	"...and the pictures can represent the story." (T-3)
	Design	"It would be better if the cover was made more attractive (provided with varied pictures) and used more striking colors". (T-4) "It would be more interesting if the presentation of the material was presented in word balloons like in comics, so that it is not monotonous, because children get bored easily if the presentation is in the form of paragraph". (T-6)
	Need of glossary	"To increase vocabulary, children can be given a glossary or explanation of the meaning of unfamiliar words, such as x-ray, postur, etc. because there are some terms that may be uncommon to children". (T-7)
	Writing format	"...students did not like books with many texts. Also, in writing one sentence there is still repeated use of conjunctions. Writing the benefits of bones would be better given points 1,2,3 or ABC without using symbols." (T-8)
	Layout	"The layout and also the used font could be made more beautiful, so that it is not as formal as possible." (T-9)
	Illustration and animation	"It is necessary to add pictures or videos or animation that provide imagination of movement and thought patterns in accordance with children's personality development". (T-10)

and learning process.<sup>3</sup> Some research has been done on this anatomy learning media, and many have also developed android-based learning media, augmented reality, and others.<sup>9-11</sup> However, those developed media were mostly not from medical fields and tended toward technology usage to attract students, but experts from the medical will understand the content better because anatomy is the basic science of medicine. In addition, usually, the media that had been developed only directed to the content of its science material, so there was less applicable educational content in the media. The Anato-Smart media created by the author is included in interactive e-books following Almekhlafi's book criteria<sup>12</sup> because it uses a variety of multimedia elements, not simply images and text, such as photographs and videos. Apart from that, hyperlinks in the media include several types of assessments or quizzes. If utilized to instruct children, the impact of e-books on learning would have been different. E-books are more appropriate for pupils in basic schools than for those in higher education, according to Quan-Haase et al.<sup>13</sup> Based on their students' needs and views, attitudes, and preferences, teachers integrate technology in various ways. Some people may utilize technology to interact with students, help them study independently, involve them in their education, improve their comprehension of subject matter, and collaborate with other students. Others appreciate using technology in the classroom because it facilitates varied learning styles, saves time and effort, and makes learning pleasurable for kids<sup>12,14</sup>. Anato-Smart media can help students' knowledge engage when teachers use it with two-way communication with students. The developed storyline in the Anato-Smart book could help students understand the dangers that occur in limbs and skeletal bones in daily life. This result fits the recommended learning method for science subjects through scientific ways that could foster thinking skills.<sup>7</sup> The example of daily activities usage could also add insight and creativity to students.<sup>15</sup> Besides, there were some quizzes with various forms, one of them is a puzzle because it can improve student learning outcomes in science lessons.<sup>16</sup>

From the evaluation questionnaire, 58.3% of participants strongly agreed that the Anato-Smart media was attractive. This result was related to the form of the media, which had illustrated stories. Storybooks with pictures can be used as media to increase children's interest in reading and attract children's attention to learning.<sup>17</sup> Images could also improve the learning outcomes of elementary school students in getting to know the human skeleton.<sup>18</sup> Although this book was considered very good and helpful, it also had weaknesses from the teacher's perspective that needed to be improved to provide even more benefits. Almekhlafi (2021) sheds light on the significance and use of e-books in educational settings in various contexts and nations because of their benefits and usefulness.<sup>12</sup> To make this book more attractive, we can develop other media apart from videos, such as puzzles based on 'Make a Match' because it can be used to learn while playing<sup>19</sup> or books combined with augmented reality to facilitate student understanding and interest the students by the applications that can show human locomotor material in 3D.<sup>9</sup>

## CONCLUSION

The development of Anato-Smart interactive storybook media, which aimed at stimulating the analytical skills of 5<sup>th</sup> graders in elementary school related to knowledge of the skeletal system and its functions, is felt to be very useful and could be used as a supplement for teachers in teaching human anatomy, especially the limb and skeletal system. Teachers' evaluations will be considered as we work to make this Anato-Smart media more helpful and extend its benefits to all 5<sup>th</sup> graders, not just those at Muhammadiyah 1 Surakarta Elementary School. Further collaboration between medicine and parties who can contribute to the development of teaching media for elementary school students, such as IT, design, and others, was needed to produce media that could be useful in a wider scope. In addition, it was also necessary to make a video version of the story from this interactive book to adjust to the pandemic conditions that make students interact more often using gadgets and also because

students disliked media in the form of books with many writings.

## ACKNOWLEDGMENT

The authors thank Sebelas Maret University for funding this community service.

## CONFLICT OF INTERESTS

This study did not have any conflict of interest.

## RESEARCH FUNDING

This study received grants from the university as a part of community service at Universitas Sebelas Maret (UNS).

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