Validity of an Augmented Reality Wall-Magazine Project with Stunting Context on Data Display

Cut Morina Zubainur[1*], Maulita Syafira[1], Cut Khairunnisak[1], Muhammad Nazar[1], and Yulinar Safitri[2]

[1] Department of Mathematics Education, Universitas Syiah Kuala, Banda Aceh, Indonesia
[2] Research Center of Realistic Mathematics Education, Universitas Syiah Kuala, Banda Aceh, Indonesia
cutmorinazubainur@usk.ac.id

Abstract. The impact of stunting remains a significant concern, with various efforts made to address it. However, current attempts to minimize the impact of stunting through classroom learning are limited. This study proposes the implementation of a wall-magazine as a learning project. The project was incorporated with augmented reality (AR) to counter waning interest of students in reading wall-magazine. Data display topic was chosen as it aligns with the project's objectives. This research aims to develop a valid AR wall-magazine project with stunting context in mathematics learning. The study employed the Plomp's model development research, specifically the prototyping and assessment stages. Data sources included lecturers with AR expertise and junior high school mathematics teachers. The research instrument employed was the validation sheet for the AR wall-magazine project with stunting context. A descriptive analysis of expert and practitioner recommendations was conducted to assess the project's validity based on predefined indicators. Results indicate that the developed wall-magazine project meets the content and construct validity criteria for theoretical/logical aspects. This research implies that the AR wall-magazine project with stunting context in mathematics learning, warrants further testing for practicality and effectiveness.

Keywords: Augmented Reality, Data Display, Validity, Wall-Magazine Project.

1 Introduction

Stunting is characterized by impaired child growth, resulting in short stature due to chronic malnutrition. Affected children are generally susceptible to diseases, exhibit below-normal intelligence, and demonstrate low productivity. Chronic malnutrition, lasting from fetal development in the womb to 24 months of age, hinders optimal growth and development in children [1].

The prevalence of stunting in Indonesia stands at 24.4%, below Myanmar at 35% but higher than Vietnam (23%), Malaysia (17%), Thailand (16%), and Singapore (4%) [2]. In 2021, East Nusa Tenggara (NTT) recorded the highest national stunting rate at

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37.8%, affecting 1 in 3 children under five. Following NTT, West Sulawesi reported a stunting rate of 33.8%, followed by Aceh (33.2%), West Nusa Tenggara (NTB) (31.4%), and Southeast Sulawesi (30.2%). Subsequent provinces include South Kalimantan (30%), West Kalimantan (29.8%), Central Sulawesi (29.7%), and Papua and Gorontalo (29.5% and 29%, respectively) [3].

The impact of stunting is profound on school-age adolescents, potentially hindering future economic growth. Early prevention is crucial. Current efforts involve the distribution of blood enhancement tablets to adolescent girls and the promotion of physical activity and balanced nutrition. However, these efforts primarily rely on verbal information and are not integrated into classroom learning, reducing effectiveness.

To address this gap, one proposed approach involves incorporating stunting prevention efforts into classroom learning through math learning projects. A wall-magazine is a specific type of project used in mathematics to help students achieve the learning objectives. Wall-magazine, commonly found in schools and offices, is an informative and entertaining communication medium displayed on walls. It aligns with magazine principles, incorporating writing, pictures, or a combination of both [4]. Wall-magazine plays essential roles as a means of communication, affordable and simple entertainment, a tool for community bonding, and a platform for creativity development [5]. Integrating stunting prevention messages into wall-magazine projects can actively engage students in addressing the stunting issue within the school environment.

Information about stunting can be effectively conveyed through the use of wall-magazines. Making stunting the theme of news for wall-magazines is expected to capture students' attention. Students' interest in reading a wall-magazine is declining, possibly influenced by technological advancements [6]. Students may be reluctant to wait in queues to read a wall-magazine, especially if it requires standing for an extended period. Technology, particularly Augmented Reality (AR), can be employed to make wall-magazines more appealing to students.

Augmented Reality is a technology that seamlessly integrates digital content computers create with the real world in real time. AR allows users to view 2D or 3D virtual objects projected on the real world. An AR wall-magazine is digitally presented, making the information more engaging for readers. This digital presentation appears more realistic and offers mobile accessibility [7].

Applications such as Assemblr EDU and Canva can be employed to maximize the use of AR. Assemblr EDU is a platform to make learning activities more active, interactive, collaborative, and enjoyable through 3D and AR features, allowing teachers to render abstract concepts more tangible [8]. Meanwhile, Canva is a user-friendly graphic design and content publication platform, offering quick and easy operation compared to other software [9]. It supports various design needs, including image designs, videos, presentations, mind maps, infographics, and planners. Canva's features cater to novice and experienced users, facilitating the creation of designs supporting learning activities. Canva proves beneficial for teachers in creating presentations, designing Instagram content, editing videos, designing banners, and more. In addition, Canva platform can be used in learning through gadgets [10]. The use of Canva-based learning materials can promote students' mathematical problem-solving abilities and grasp the subject matter [11].

AR wall-magazine with stunting context can serve as an effective learning project, particularly in math learning. This wall-magazine project, complemented by AR, can be integrated with other learning projects, such as compiling food menus, creating games, developing comics, and more. Integrating technology into wall-magazine enhances its appeal and aligns with contemporary teaching methods, creating a dynamic and engaging learning experience for students.

A wall-magazine project, particularly one integrated with AR and focused on stunting, is an effective math learning initiative, specifically targeting data display. The learning objectives of data display encompass problem-solving related to mean, median, and mode. Within the AR wall-magazine with stunting context, students engaged in project assignments centered on stunting-related problems. The sequence of activities begins with imparting information about stunting through the wall-magazine format. Subsequently, students articulate details about stunting using various diagrams for data display, including mean, mode, and median. The subsequent activity involves students narrating data about stunting presented in the diagrams. Following this, students tackle problems related to stunting using mean, mode, and median calculations. This pedagogical approach underscores the appropriateness of problem-solving as a learning strategy for teaching data presentation material within a specific context.

The utilization of wall-magazine as a mathematics learning project, particularly those integrating AR focusing on stunting, remains significantly underexplored. This insight is gleaned from a needs analysis conducted. Recognizing the importance of this learning project can significantly aid students in attaining math learning objectives while fostering an understanding of the impact of stunting and associated prevention efforts. Given its potential, these learning projects are crucial for teachers to integrate into classroom settings. However, before implementation, the AR wall-magazine project with the stunting context must meet established standards for validity. Therefore, the primary aim of this research is to produce a valid AR wall magazine project within the context of stunting, ensuring its suitability for integration into mathematics learning environments.

2 Methods

This study employed key stages of the Plomp [12] model development research, specifically the preliminary research and prototyping phases of the three-stage model (preliminary research, prototyping, assessment). During the preliminary research stage, various factors such as curriculum analysis, literature and learning resource reviews, existing tools, school situations, teacher and student needs, and other pertinent aspects were examined. This comprehensive analysis led to the decision to develop the AR wall-magazine project with the context of stunting.

Data display topic was selected based on its alignment with the project's objectives, particularly in conveying information about the prevalence and impact of stunting. The learning objectives involving mean, median, and mode presentation through various

diagrams were deemed suitable for implementation through wall-magazine, further enhanced with the integration of AR. Subsequently, during the prototyping stage, the development of the learning project was initiated.

The data sources for this research include lecturers with expertise related to AR and junior high school mathematics teachers. The research instrument utilized was the validation sheet for the AR wall magazine project within the context of stunting. Research data, comprising expert and practitioner recommendations, underwent descriptive analysis to ascertain the project's suitability based on validity indicators. Aspects of validation, measuring the quality of the AR wall-magazine project with the context of stunting, include the content and construct validity. Content validity ensures that the model aligns with the curriculum or is based on a strong theoretical foundation, while construct validity examines internal consistency between model components, ensuring their harmonious integration [12].

Aligned with the research objectives of producing a valid AR wall-magazine project with stunting context, the project underwent development during the design/prototyping phase. Subsequently, the project's validity was assessed through validation by lecturers and mathematics teachers with the necessary expertise. The teachers involved held teaching certifications and were assigned to junior high schools, specializing in the selected subject matter—data presentation. The validation sheet for the project served as the instrument.

Data generated during the preliminary research stage, obtained through interview documentation, underwent descriptive analysis. This analysis aimed to characterize interview data from teachers regarding the school curriculum, materials, student learning resources, learning situations/conditions at school, and required learning tools, especially learning projects.

In the prototyping stage, an AR wall-magazine project with a stunting context was developed and subsequently assessed for validity. The validation analysis incorporated indicators, including expert consensus on the project's strong theoretical basis and consistent interrelation of project components, as outlined by [12]. At least three out of four experts were required to validate each criterion for the overall validity of AR-assisted wall-magazine project with stunting context.

3 Results and Discussions

3.1 Results

The prototyping stage commenced with an analysis of learning objectives centered on data presentation. This analytical process involved categorizing learning objectives based on the learning domain types—students' knowledge, attitudes, and skills. The primary goal of this analysis was to identify activities within the learning project that will aid students in acquiring the formulated competencies.

The overarching learning objective was for students, through the completion of the wall magazines project assignment, to proficiently solve problems related to data presentation. This was intended to be achieved through problem-solving activities contextualized within the theme of stunting throughout the wall magazine project. Students

are tasked with representing or interpreting the presented data, involving transformations from one form of information to another, such as converting a table into a narrative or vice versa. This activity aims to train students in data interpretation. Subsequently, the AR wall-magazines project with the context of stunting were developed, utilizing applications such as Canva and Assemble Studio.

Canva, a user-friendly graphic design and content publication platform, offers ease of operation compared to other software. Its versatile features enable the creation of image designs, videos, presentations, mind maps, infographics, planners, and more. Canva's user-friendly interface ensures even novice users can easily design. It proves instrumental for teachers in supporting various learning activities, from creating presentations and Instagram content to designing banners and editing videos for diverse social media platforms. The platform's capabilities also extend to designing posters, flyers, brochures, advertisements, postcards, business cards, newsletters, invoices, as well as compiling infographics, mind maps, photo collages, virtual backgrounds, calendars, worksheets, planners, concept maps, and wallpaper/gadget screen backgrounds. Additionally, the utilization of Canva aligns with the Merdeka Curriculum's digitalization element, fostering creativity among teachers and students through various cyberspace platforms for teaching and learning.

The learning activity associated with the AR wall magazine project within the context of stunting comprised three sessions. Fig. 1 illustrates the appearance of the project. QR (Quick Response) codes, resembling barcode evaluations typically found on products, serve as a concise evaluation form. These QR codes enhance the interactive and evaluative aspects of the project.

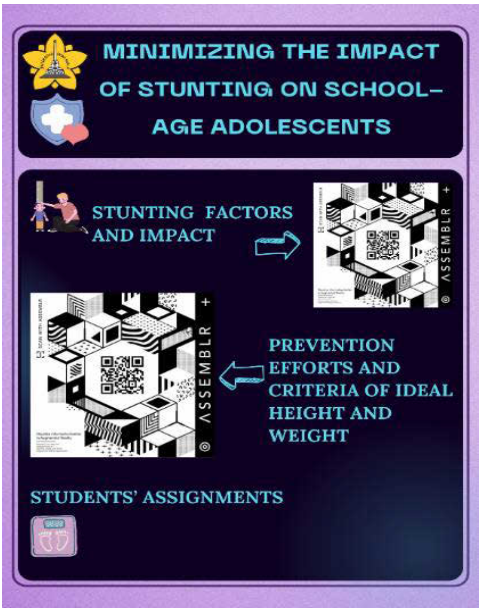

Fig. 1. Display of the AR wall-magazine project with stunting context.

On the first day, information about stunting was conveyed through the wall-magazine project. This information was presented as data display, accompanied by a QR code to facilitate student access to augmented reality (AR)-enhanced content. The instructional activities were structured as assignments. QR Code 1, accessible to students on the initial day, provides information about stunting through data presentation, as depicted in Fig. 2. Within QR Code 1, the data presentation material is intricately delivered within the context of stunting. It commences with an introduction to stunting, elucidating its impact and outlining efforts that can be undertaken to mitigate its effects.

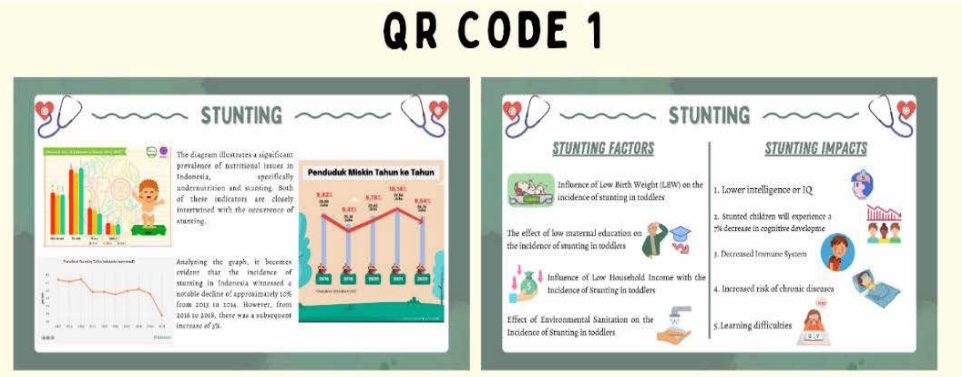

Fig. 2. Information in QR Code for the first day of learning on the the AR wall-magazine project with the context of stunting.

On the second day, students were assigned tasks involving data presentation, requiring them to represent the data through diagrams and provide a narrative. The researchers posed two problems as part of the task. QR Code 2, accessible to students on the second day, delivers information about stunting through data presentation, as shown in Fig. 3.

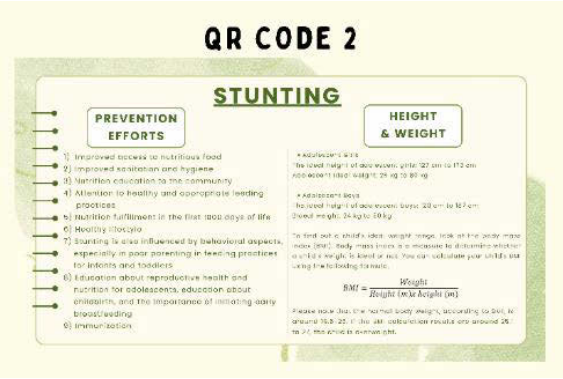

Fig. 3. Information in QR Code for the second day of learning on the AR wall-magazine project with the context of stunting.

Students transform their completed tasks on the third day into a wall-magazine project. They finalized the task and presented it in the wall-magazine format. Subsequently, the wall-magazine project was encoded into a QR Code, enabling it to be viewed in AR. The QR Code serves as a link to access the students' assignments. Additionally, during the meeting, students showcase and elaborate on their completed tasks, encapsulated in QR Code 3, as illustrated in Fig. 4.

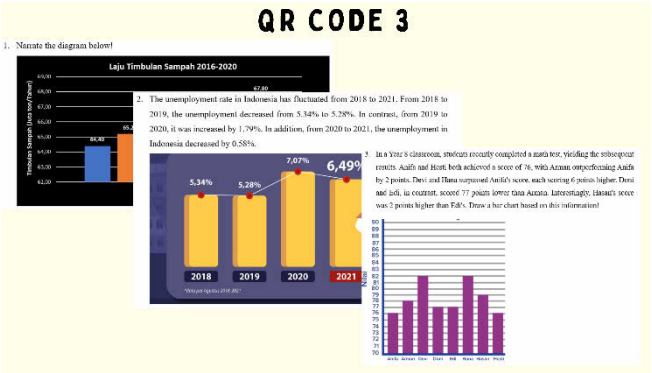

Fig. 4. QR Code for the third day of learning on the AR wall magazine project with the context of stunting.

The AR wall-magazine project with the context of stunting developed is called Prototype 1. Activities at the prototyping stage involved validation by experts to assess content and construct validity. Recommendations and suggestions from the validators were used to enhance Prototype 1. Following these improvements, the subsequent AR wall-magazine project with the context of stunting is labeled as Prototype 2. The validators' recommendations and suggestions were considered within the context of the validation aspects, specifically content and construct, to determine the quality of the project.

The results of content validation indicate that the developed project aligned with the current school curriculum, namely the Merdeka Curriculum. This alignment was evident in the competencies students acquired through wall-magazine project activities, by the learning outcomes for Year 8 students. These outcomes include students reaching phase D proficiency, where they can formulate questions and collect, present, and analyze data. Students can utilize bar charts and pie charts for data display and interpretation, take representative samples, and determine and interpret measures of central tendency (mean, median, mode, and range) to solve problems. Additionally, they can investigate potential changes in central measurements resulting from changes in the data.

Furthermore, the validators' recommendations affirm that the chosen learning model for implementing the project is grounded in a strong theoretical rationale. The selected learning model, the Project-Based Learning (PjBL) model, is known for utilizing problems as the initial step in collecting and integrating new knowledge based on students' experiences and real activities. PjBL addresses complex problems that students need to investigate and understand [13]. This learning model, characterized by students completing projects as learning products, aligns seamlessly with the core activities of the

AR wall-magazine project within the stunting context. These activities involve problem-solving regarding stunting through data display material, culminating in learning products produced by students.

Meanwhile, the validator's assessment of the construct validity of the project with the context of stunting revealed internal consistency among the model's components. Each component of the model did not conflict with others, as indicated by the congruence between project components. This included the alignment of learning outcomes with project activities and the presence of a stunting context, facilitating students' comprehension of concepts like mean, median, and mode and their application in addressing stunting-related problems. Additionally, the integration of AR proves highly beneficial, enabling students to visualize real data displays and maximizing learning resources through informative media about stunting via data display.

Based on the validator's conducted validation, it was observed that the project has achieved content and construct validity. Moreover, the learning project is now poised for testing practicality and effectiveness, with the aim of its eventual application in classroom learning. The validation results of the AR wall-magazine project with the context of stunting presented in Table 1 and were elaborated upon in the subsequent description.

Table 1. Validation results of AR wall-magazine project with context of stunting.

Components of Validation	Aspects	Validators Recommendations (Mean)
Content	Project completeness	5
	The alignment between project activities and learning outcomes	5
	The alignment between project activities and data presentation material competencies	5
	The alignment between project activities and the chosen learning model	4.5
	The alignment between context and learning material	5
Construct	The alignment between project activities and learning objectives	4.75
	The alignment between systematic of project activities and the learning model syntax	4.5
	The alignment between project activities and stunting problems	4.5
	The alignment between applied technology and expected competencies	5
	The alignment between project activity time allocation and learning time allocation in the lesson plan	5
	Total Mean	4.6

3.2 Discussions

The development of the AR wall-magazine project with the context of stunting for data display were completed. The project has met valid criteria for both content and construct aspects. Teachers can employ the project for data display and help students in understanding the issue of stunting, which is currently a national concern. This project holds the potential to serve as a pilot initiative to engage students in minimizing the impact of stunting on school-aged youth through mathematics learning activities in the classroom. Currently, students are less engaged in solving problems related to stunting [1].

The project was developed utilizing AR technology, acknowledging that AR can help students visualize real information about stunting. AR is a technology achieved through the real-time merging of computer-generated digital content with the real world. It facilitates students' visualization of 2D or 3D virtual objects projected onto the real world. AR fulfills these needs as it can integrate virtual objects, including text, images, or animations, into the real world. AR combines three features: the combination of digital and physical worlds, real-time interaction, and accurate 3D identification of virtual and real objects. This technology can be accessed with the help of camera devices on mobile and desktop. AR allows users to add moving images, animated text, or other visual elements to objects in front of the camera [14], [15]. Utilizing AR can train students to use technology for positive purposes. Contemporary students tend to be sensitive and enthusiastic about applying technology to various aspects of life [16], [17]. AR uses a smartphone or tablet screen to present a visual display that does not exist. An example commonly used today is the application of filters on TikTok [15]. AR is a highly desirable way to maximize student competency [18].

In the project, the Canva and Assemble Studio applications were employed. Canva is an online design and visual communication platform that aims to empower everyone worldwide to create any design and publish it anywhere [9], [19]. Assemble Studio uses 3D and AR features to make learning activities more active, interactive, collaborative, and enjoyable, allowing teachers to deliver abstract concepts more real [8].

Using the AR wall-magazine project with the context of stunting can support the School Literacy Movement (SLM). SLM is implemented in schools as an effort to enhance student literacy. Teachers can engage in various activities to cultivate literacy in schools, including observation, creation, information gathering, appreciation, publication, and exhibitions [20]. Implementing SLM can take various forms, such as providing interesting books for students, allocating 15 minutes before class for reading, maintaining a reading diary, creating a text-rich environment and reading corner, organizing various competitions to support literacy, establishing an attractive library for students, forming reading groups, creating inspiration boards, and more. However, the SLM currently lacks diversity in media beyond books. The use of the AR wall-magazine project is expected to enrich SLM activities.

The project developed has met valid criteria for content and construct aspects. However, the project needs to undergo testing to evaluate its empirical validity, practicality, and effectiveness before implementation in classroom learning. It is essential to measure its implementation and its impact on student outcomes. The responses of students

and teachers are also crucial to ensuring that the project meets the expected quality standards.

4 Conclusion

The AR wall-magazine project with the stunting context meets the valid criteria, covering the content and construct validity. Content validity indicates that the project aligns with a strong theoretical rationale for both the Merdeka Curriculum and the PjBL model. Meanwhile, construct validity demonstrates internal consistency among the components of the project. As a result, the project developed in this study is feasible to be tested for its practicality and effectiveness before teachers applying it in the classroom.

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