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Product Innovation Using the Scrum Framework in Children's Educational Games, Focusing on Augmented Reality Products: the Seven Wonders of the World to Achieve SDG Number 4

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ABSTRACT

In business, creating the best product that meets consumers' wants and needs is crucial. While various similar products can compete with a company, consumers choose only one product that best meets their needs and solves the problem for which they are selecting the product. Scrum is a comprehensive framework grounded in empirical processes and has undergone repeated evolution over the past 20 years. Based on the research results, project management using the Scrum method helps researchers to produce augmented reality products that focus on educational games.

Keywords: Product, Augmented reality, Education

1. Introduction

A product is anything that can be offered to consumers for attention, acquisition, use, or consumption (Ariwibowo, 2023). In business, creating the best product that meets consumers' wants and needs is crucial. While various similar products can compete with a company, consumers choose only one product that best meets their needs and solves the problem for which they are choosing the product. Companies must focus on research and development and other product activities to ensure their products are competitive internationally (Hasibuan, 2022). Product quality is a key factor for potential buyers when deciding to purchase goods or services with superior value (Aghitsni, 2022). One marketing strategy aimed at increasing a company's competitiveness is product development (Husniar, 2023).

While some products offer similar solutions to similar problems, creating a different product to address a specific consumer problem is a distinct advantage, also known as product innovation. Innovation is the ability to see things differently and in new ways (thinking outside the box) (Grecia & Puspitowati, 2022). Innovation is the activity of implementing new products and ideas (Lorensa & Hidayah, 2022).

Product innovation impacts marketing performance. To achieve a competitive advantage in improving marketing performance, organizations must utilize all available resources (Ramadhani et al., 2022). Furthermore, good product innovation can improve business performance (Fitri and Rizki, 2023). The resulting product innovation is not only beneficial for business continuity but also for the long-term survival of the company and employees, and has a broader impact on the regional economy. Product innovation can also create customer satisfaction. The creation of new products that align with existing trends provides a unique satisfaction for customers (Indriyani et.al. 2023). Product innovation does not focus on creating completely new products, but rather focuses on

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improving existing products and adapting them to needs, desires, and filling gaps between existing opportunities. An example of product innovation is the Tesla car. Tesla is an environmentally friendly car created by Elon Musk. Although similar to cars in general, Tesla cars use other methods to create more environmentally friendly personal vehicles, so that their cars are well-received by consumers.

Picture 1. Tesla Car

Children are the future generations of every nation. However, today's children are exposed to a variety of mind-damaging games, known as "brain rot." "Brain rot" is another term for this phenomenon. This phenomenon stems from gadget addiction and content with little positive value (Putra & Annisa, 2024). Excessive gadget use can cause children to become less sensitive and less concerned about their environment (Fuaody et al., 2024).

To prevent brain rot, preventative measures are necessary. Some preventative measures that can be taken are :

- Limiting screen time
- Being socially and physically active
- Maintaining quality sleep
- Choosing quality content
- Training the mind

(Maulina, 2025)

One way to prevent brain rot is by training children's minds so they can think well. For this reason, the author attempted to create an innovative product that helps children train their minds and explore objects of interest to them. This product innovation will also utilize technology, an integral part of the modern era, and utilize the Scrum framework to accelerate product development.

The technology used in this research is Augmented Reality (AR). The use of AR technology in learning media has been implemented by other researchers, such as Sari et al. (2022), who utilized augmented reality as a medium for introducing geometric shapes, and Hadil et al. (2023), who designed an augmented reality-based application as a medium for learning the solar system for 6th-grade elementary school students at MI Ma'arif NU 02 Karang Klesem.

AR is a technology that transforms a virtual world into a real world in 3D form through a camera and creates illustrations that are difficult to realize concretely (Meilindawati et al., 2023). Unlike virtual reality, AR simply depicts or complements reality (Rozi et al., 2021). The use of AR allows students to be more engaged in learning activities because it includes animated 3D objects (Sungkono et al., 2022). It is effective in use, can be applied in various forms, is easy to operate, is affordable, and is more interactive than other media (Widyasari & Ismawati, 2020).

To develop this product, the researchers used the Scrum framework. Scrum helps organize a team, and it requires strong communication between team members (Nugraha, Kusnadi & Rifqi, 2021). The Scrum method is a standard framework in software development used to improve collaboration and communication between team members (Azriel, Natalio, 2024). Scrum, as a widely used agile model, emphasizes independent and effective organization and continuous improvement (Ramin et al., 2020). Furthermore, the Scrum framework encourages regular communication with product owners through continuous iteration, increasing customer involvement in the development process (Yahya & Maidin, 2023).

Researchers are also focused on realizing Sustainable Development Goal (SDG) number 4. SDG number 4 is quality education, ensuring inclusive and equitable education in quality and supporting lifelong learning opportunities for all children. Many challenges remain in realizing SDG 4, such as a lack of infrastructure, skilled personnel, and policies that do not support the creation of quality education. Therefore, the research team tried to create a tool to support students in understanding complex structures and transforming them into interactive and understandable learning. Some points in SDG number 4 are:

Goal 4.1

By 2030, the target is to ensure that every child, both boys and girls, completes primary and secondary education. This education should be free, high-quality, and non-discriminatory, resulting in relevant and impactful learning outcomes.

Goal 4.2

By 2030, ensure that all children, regardless of gender, have access to integrated, quality early childhood development (ECD) services, including preschool care and education. This aims to optimally prepare them for entry into primary education.

Goal 4.3

By 2030, ensure that all individuals, men and women, have equal opportunities to access affordable, quality secondary education, including technical and vocational training, and higher education, such as university.

Goal 4.4

The target for 2030 is to drastically increase the proportion of young people and adults who possess skills in demand in the labor market, including technical and vocational skills, to secure decent work and foster entrepreneurship.

Goal 4.5

By 2030, the focus is on eliminating all gender inequalities in education. Furthermore, ensure equal access to all levels of vocational training

and education for the most vulnerable groups, including individuals with disabilities, indigenous communities, and children in difficult situations.
Goal 4.6
Aim to ensure by 2030 that all adolescents and a substantial proportion of adults—both men and women—have basic skills in literacy (reading and writing) and numeracy (counting).
Goal 4.7
By 2030, strive to ensure that all learners acquire the knowledge and skills essential to advance sustainable development. This is achieved through education on sustainable lifestyles, human rights, gender equality, the promotion of a culture of peace, non-violence, global citizenship, and appreciation of the contribution of culture to development.
Goal 4. a
Develop and improve educational facilities and infrastructure to be child-friendly, inclusive of persons with disabilities, and gender-sensitive. The goal is to create a safe, violence-free, inclusive, and effective learning environment for all.
Goal 4.b
By 2020 (even if the deadline has passed, this goal can be changed to "Continue efforts...") Significantly expand the availability of scholarships globally for citizens of developing countries, especially least developed countries (LDCs), small island developing States (SIDS), and African countries. These scholarships are intended for pursuing higher education, such as vocational training, ICT, engineering, and science programs, in developed or other developing countries.
Goal 4.c
By 2030, significantly increase the number of qualified teachers. This increase will be achieved, among other things, through international collaboration on teacher training in developing countries, especially LDCs and SIDS.

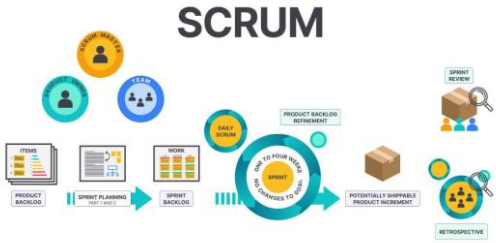
Researchers use a combination of AR technology and the Scrum framework to create product innovations, accelerating product development and achieving a clear direction. Other similar studies using product innovation methods include Juli et al. (2021) and Hanifawati & Ratna (2021), which yielded positive feedback on consumer purchasing decisions. Other studies using AR technology include Aditia (2020) and Khairunissa & Tian (2021), which found that AR technology positively impacts learning engagement, interest, and motivation in learning activities. Regarding the use of the Scrum framework, other studies have been conducted by Marcellino et al. (2024) and Rizky & Yuni (2022), which used the Scrum framework and reviewed the use of Scrum in other studies.

2. Method

Another study focusing on augmented reality technology is Augmented Reality (AR), a new branch of virtual reality. It is a technology that allows users to interact with a computer-simulated environment, either a simulated real-world environment or a new environment that exists only in a computer environment (Robianto et al., 2022). AR also aids product marketing (Fernando et al., 2021).

Furthermore, Scrum is a framework designed to handle complex and changing products (Fuadi & Teguh, 2020). Scrum is a comprehensive framework grounded in empirical processes and has undergone repeated evolution over the past 20 years (Anonymous, 2020).

The importance of product innovation has been emphasized by other researchers, such as Azhari & Ali (2024). Product innovation plays a crucial role in maintaining a company's competitiveness and relevance by introducing new or improved products or services that better meet customer needs and desires than competitors. Product innovation also impacts a company's revenue (Putri & Arif, 2023).



Picture 2. *Scrum Framework*

According to Warkim et al. (2020), Scrum emphasizes three main pillars: transparency, inspection, and adaptation. Transparency ensures that critical aspects of the development process are open to all involved, facilitating regular review of progress and adaptation of strategies based on feedback and necessary changes.

Scrum focuses on specific roles, artifacts, and activities that facilitate communication and teamwork. The three main roles within the Scrum framework are as follows:
a) The Product Owner is the individual responsible for continuously communicating with the development team regarding the vision and priorities, thereby producing a product with high added value.
b) The Scrum Master acts as a facilitator for the product owner and the development team, consisting of developers and testers (Quality Assurance). The Scrum Master helps the team overcome obstacles and achieve goals, and provides recommendations to the product owner on how to maximize the team's potential.
c) The Development Team manages the technical aspects of the project. The Development Team typically consists of five to nine members (Andipradana & Dwi Hartomo, 2021).

The Scrum concept consists of several stages, starting with the Product Backlog, Sprint Planning, Sprint Backlog, and Sprint Restorative.
- **Product Backlog**

A collection of all requirements or desired features in the product. This is the initial foundation that will continue to evolve. The first

stage of Scrum integration is the product backlog, a software project prioritization process cycle that plays a significant role as the basis for design. Product backlogs are flexible, allowing for insertion or additions at any time, ensuring they are updated according to priority needs. The product backlog is the initial stage in using Scrum to create a product priority list (Tumbade et al., 2024)

- **Sprint Planning**

The team determines which work will be worked on in one sprint cycle (usually 1–4 weeks). Focus on the highest priorities. Based on the results of the product backlog analysis, the second stage of Scrum integration, the sprint backlog, continues. This stage defines further development tasks. This definition includes planning, daily tasks, descriptions, and consideration of sprint features to be built based on research data. The sprint backlog process is carried out individually, not by teams (Tumbade et al., 2024).

- **Sprint (Iteration)**

A fixed period of time to work on selected items from the backlog until completion. Each sprint produces a usable product.

- **Daily Scrum (Stand-Up Meeting)**

A short daily meeting (15 minutes) to discuss progress, obstacles, and the day's plan. This promotes transparency and collaboration. Transparency regarding issues can be seen through the daily events in Scrum. The purpose of the Daily Scrum/Stand-up is "to review progress toward the Sprint Goal and adapt the Sprint Backlog and adjust the upcoming work plan" (Schwaber & Sutherland, 2020). The Daily Scrum is about self-organization and about employees determining their own work to be completed within the Sprint Goal. Each employee or person on the development team in the Daily Scrum presents what they have learned in the past 24 hours to their immediate team, and in total, the meeting/event takes 15 minutes (Schwaber & Sutherland, 2020).

- **Sprint Review**

At the end of the sprint, the team presents the results of its work to stakeholders. Feedback is immediately used for improvement. Formal procedures of Sprint Review allow every member of the team to contribute to the development of the project and address problems (Muthucumaru, 2021).

- **Sprint Retrospective**

An internal team evaluation to review what went well and what needs to be improved in the next sprint. As reported by several studies, the Sprint Retrospective is an agile practice most likely to be implemented improperly or sacrificed when teams perform under pressure to deliver. To facilitate the implementation of the practice, some agile coaches have proposed setting up retrospective meetings in the form of retrospective games (Przybylek et al., 2021).

The object of this research is to focus on creating products that educate children with the help of AR. The subject of this research is to utilize the Scrum framework to create the best product to educate children. The location of this research is at the Palcomtech Institute of Technology and Business.

3. Result & Discussion

3.1 Result

Picture 3. AR Product

Picture 4. AR with Assembler Website

The outcome of the Agile Scrum activities was the creation of an augmented reality product focused on education. The resulting product is an academic product containing knowledge about the Piramida, the Chinese Great Wall, Petra, Cristo Redentor, the Colosseum, Machu Picchu, and Chicken Itza.

-Product Backlog

Create educational cards that display information about the wonders of the world, and can be scanned using a camera to display interactive content in AR format.

-Sprint Planning

Developing a card scanning feature using AR technology, creating 3D visual models of the wonders of the world, and adding voice-overs to support children's learning experiences.

Increment

AR markers can be recognized, and 3D characters appear. These results are in 7 cards that can be scanned. All of this can be done on the device.

Daily Scrum (Stand-Up Meeting)

A short daily meeting (15 minutes) with a daily discussion: What was done yesterday? What will be done today? Are there any obstacles?

-Sprint Review

At the end of the sprint, a 3D 7 Miracle in the World model will be displayed that can be rotated and studied. Review the summary/collected material.

To use this product, consumers must complete several steps. These steps are as follows:

- Select the card to be used for learning.
- Scan the QR code on the back of the learning card.
- After successfully scanning the code, consumers will be directed to the Assembler website.
- On the Assembler website, consumers click "Scan Marker" and then scan the selected learning card again.
- The consumer has successfully used the product.

Picture 5. Education for Children uses AR

Figure 4 shows an example of a learning product that can train children's thinking patterns and support further independent exploration. For example, the AR learning product with the Pyramid of Giza model, as shown in Figure 4, contains the meaning of the Pyramid of Giza's founding. If children still want to learn more about the Pyramid of Giza, they can research unique facts about it themselves.

Our product consists of the Seven Wonders of the World. These include the Pyramids of Giza, the Colosseum, Machu Picchu, the Great Wall of China, Petra, the Statue of Christ the Redeemer, and Chichen Itza.

Scrum implementation creates transparency that reduces the risk of miscommunication and ensures everyone has the same understanding of the project (Alami & Krancher, 2022). Transparency facilitates faster identification of problem resolutions. Effective coordination in multifunctional teams relies on a high level of transparency to avoid miscommunication and increase work efficiency (Dingsoyr et al., 2018).

Scrum also reduces communication barriers that can slow down the development of a project or product. The Scrum framework can address communication challenges in distributed teams. With technological advances, communication barriers can be resolved through video conferencing, video calls, and chats to maintain smooth and efficient communication (Shafiq et al., 2019).

Implementing Scrum, team productivity increases due to better communication and more effective coordination (Azriel and Natalio, 2024). During each sprint, the team sets clear and achievable goals to maintain team focus. Scrum enables companies to continuously improve their products in the market. With a retrospective at the end of each sprint, teams can conduct measurable evaluations based on the initial plan (Rizky & Sugiarti, 2022).

Product quality also improves rapidly due to rapid feedback. Teams receive immediate feedback from stakeholders, allowing for faster product adjustments (Azriel, Natalio, 2024).

Scrum also helps product development activities become flexible and adaptable to change. The hybrid model in Scrum optimizes communication and provides greater flexibility, allowing teams to adapt methods to specific projects (Yahya & Maidin, 2023).

Augmented Reality (AR) products with educational content about the Seven Wonders of the World substantially strive to improve the quality of education and achieve SDG 4. The main contributions of this technology implementation are as follows:

1. Improving Knowledge and Skills for Sustainable Development (Target 4.7)

The integration of AR visualizations of World Heritage sites directly supports the development of global citizenship and fosters an appreciation for cultural diversity and contributions.

AR technology facilitates immersive exploration, transforming abstract concepts of geography and history into tangible experiences. This is essential for internalizing an understanding of the preservation of cultural and natural heritage (a sustainable development aspect). Through strategically designed modules, this product conveys the importance of world heritage, encourages learners to appreciate cultural contributions, and understand the need for its preservation.

2. Creating an Effective and Inclusive Learning Environment (Target 4.a)

AR products serve as innovative tools that enhance pedagogical effectiveness in the learning environment. The use of AR has been proven to increase student engagement and motivation by transforming static materials into interactive 3D experiences. This directly contributes to providing an effective and inclusive learning environment for various learning styles, particularly visual and kinesthetic learners, thus facilitating more equitable access and understanding of the material.

3. Improving the Quality of Learning Outcomes (Target 4.1)

The implementation of AR technology in the curriculum (especially history and geography) helps improve the quality of primary and secondary education. By providing accurate and rich visual representations, AR supports the achievement of relevant and effective learning outcomes. This application ensures that students are able to understand the complexity and scale

of global sites, which are often difficult to grasp through conventional teaching methods alone.

3.2 Discussion

This discussion will be based on the research findings obtained in this study. The results indicate that product creation can be effectively implemented using the Scrum method:

1. Product Innovation for Business Sustainability

Innovations created using AR technology create AR products that are technologically superior while remaining educational for children. This aligns with findings from Rijal et al. (2023), which state that product innovation can impact regional economic performance. Product innovation can also improve the performance of MSMEs in Waingapu City (Tingal & Tumpal, 2024).

2. Scrum Framework for Product Development

The Scrum Framework is used to assist companies or start-ups in more effective and efficient product development. Other researchers have utilized the Scrum Framework. It was used by Suarezsaga et al. (2022) in developing a Business Travel Information System, completing nine features in 36 days.

3. Utilization of AR in Learning

The use of AR to enhance students' learning experiences has been studied by other researchers. The implementation of AR in learning has the potential to change learning methods, alter perceived learning experiences, and make them more interactive and engaging, while also influencing student learning engagement (Rachim et al., 2024).

4.CONCLUSION

Based on the research results, project management using the Scrum method helps researchers to produce augmented reality products that focus on educational games. Scrum implementation creates transparency that reduces the risk of miscommunication and ensures everyone has the same understanding of the project. The Scrum framework can address communication challenges in distributed teams. With technological advances, communication barriers can be resolved through video conferencing, video calls, and chats to maintain smooth and efficient communication. Scrum enables companies to continuously improve their products in the market. With a retrospective at the end of each sprint, teams can conduct measurable evaluations based on the initial plan. Scrum also helps product development activities become flexible and adaptable to change.

Augmented Reality (AR) products with educational content about the Seven Wonders of the World substantially strive to improve the quality of education and achieve SDG 4. The main contributions of this technology implementation are as follows: Improving Knowledge and Skills for Sustainable Development (Target 4.7), Creating an Effective and Inclusive Learning Environment (Target 4.a), Improving the Quality of Learning Outcomes (Target 4.1).

LIMITATION AND STUDY FORWARD

A limitation of this study is the limited validation of the product prototype, and further research is needed to improve the product and ensure it is usable by consumers.

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