The Development of Augmented Reality Media on Thai Rice Products for Upper Secondary Level (Grades 10-12)

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ABSTRACT
The objectives of this study were to: 1) investigate the efficiency of an augmented reality media on Thai rice products for upper secondary level (Grades 10-12) students in Pathum Thani province, 2) compare students' achievements before and after learning through the augmented reality media on Thai rice products for upper secondary level (Grades 10-12) students in Pathum Thani province, and 3) examine student satisfaction towards the augmented reality media on Thai rice products for upper secondary level (Grades 10-12) students in Pathum Thani province. The sample comprised 30 Secondary 4 (Grade 10) students at Dipangkorn Wittayapat (Mattayomwathatasankaset) School under the Secondary Education Service Area Office Pathum Thani, derived through purposive sampling technique. The instruments used for collecting the data were an augmented reality media on Thai rice products for upper secondary level (Grades 10-12) students in Pathum Thani province, a pretest and a post-test, and a student satisfaction form. The data analysis statistics were percentage, mean, standard deviation, and t-test for the dependent sample. The research findings revealed that the augmented reality media on Thai rice products for upper secondary level (Grades 10-12) students in Pathum Thani province was adequate according to E1/E2 at 82.33/81.67. The students' achievements after learning through the augmented reality media were higher than before learning. The mean and standard deviation before learning were 8.77 and 2.22, while the mean and standard deviation after education were 16.33 and 1.45. The t-test score used before and after schooling was 20.96 at a statistically significance level of .05. Moreover, the student satisfaction towards the augmented reality media on Thai rice products for upper secondary level (Grades 10-12) students in Pathum Thani province was at the high level.
Keywords: Augmented Reality media, Thai rice products, upper secondary level (Grades 10-12)

INTRODUCTION
The "Development of Augmented Reality (AR) Media on Thai Rice Products for Upper Secondary Level: Enhancing Educational Engagement and Promoting Cultural Appreciation" research project combines education, technology, and culture. This chapter establishes the study's historical, economic, and cultural context. The "Development of Augmented Reality Media on Thai Rice Products for Upper Secondary Level: Enhancing Educational Engagement and Promoting Cultural Appreciation" research project combines education, technology, and culture. Project title: "Development of Augmented Reality Media on Thai Rice Products for Upper Secondary Level: Enhancing Educational Engagement and Promoting Cultural Appreciation." This chapter provides the historical, economic, and cultural context for the subject, which is essential. Thailand's rice industry is a cornerstone of its agricultural economy and cultural heritage. Rice cultivation and production have been central to Thailand's identity for millennia. This chapter covers cultivation methods, trade patterns, and how rice supports rural and urban livelihoods. This study promotes Thai food internationally via video, website, app, and AR. The US and Japan hosted the studies. The evaluation forms tested samples' media opinions after integrated media exposure. Participants were primarily satisfied with AR, media content, and usefulness (Kheerajit et al.; N., 2019). The results also demonstrated that integrated media helps promote Thai cuisine enterprises and the Importance of Thai Rice Products to the Economy and Culture.

Rice in Thailand has a lengthy history, cultural and symbolic value, and economic importance. It is deeply ingrained in Thai culture, customs, and cuisine. This section discusses how rice shapes Thai social structures, rituals, and identity. The rise of digital technology has transformed schooling. Modern, dynamic, and interactive classrooms have replaced chalkboards and blackboards. This section discusses educational technology

advancements and their use in pedagogy. This awareness can improve technology-rich learning environments' pedagogical design and understanding of visual and interactional behaviors (Jakonen et al.; H., 2021). By offering context, it prepares Augmented Reality as a cutting-edge educational tool. This thesis seeks to comprehend technology, education, and cultural heritage at their crossroads. This will explore how augmented reality might improve academic engagement and cultural understanding of Thai rice products for upper-secondary pupils. Higher education students must use their devices to register attendance and communicate with internet systems, timetables, and virtual learning environments. Chance to use AR technology Multiple professions have used AR, demonstrating its benefits. AR's learning benefits need more research. Higher education has used AR to improve special needs students' physical, cognitive, personal, and social skills in recent years. This systematic study examined AR technology in higher education special needs research from 2011 to 2020 using 8 worldwide databases. We reviewed 36 studies. Since AR worked with disabled youngsters, most research showed positive benefits. Results revealed that intellectual disability settings used AR technology. AR enhances students' social skills, relationships, and involvement. A comprehensive study on improving special needs people is essential. Future empirical research should include settings, student levels, and quantitative and qualitative data collecting (Jdaitawi et al.; A., 2021).

Using augmented reality technology to engage students and organize the learning environment for 21st-century teaching and learning, AR superimposes virtual visuals on real-world imagery. They are using tablets, smartphones, or other visual displays. Medicine, tourism, business, education, print media, and others use to see images as if they were in real life (Kritsanaphong Lertbamrungchai., 2020). Augmented reality invites consumers to experience the natural world through their senses. Be it seeing, hearing, or feeling. Augmented reality technology can generate new kinds of response and interaction in teaching and learning, improving efficiency by merging technology with conventional instruction. When educating, make pupils enjoyable-not dull. Motivation fosters student interest and knowledge. Augmented reality helps students.

Understand lesson information better. Augmented reality brings real and virtual learning aids to mobile Internet devices, improving mobility-oriented learning. The essay advocates AR in physics classes. The article explores the application of augmented reality in education, particularly mobile distance learning. This article discusses practice-based AR smartphone apps. Real schools utilize this technology to study physical orientation. AR improves education and humanities and natural science applications. This technology simplifies instruction and motivates students. Students today benefit most from visual education, which enhances science and technology. Augmented reality boosts students to self-study, increases audience interest in educational material, develops a desire to use modern interactive technical capabilities and technologies, and replaces textbooks and laboratory equipment with multimedia computer models, improving education quality—remote learning (Gurevych et al.; S., 2021).

Thailand, another biodiversity-rich nation, has numerous precious resources. Rice has been associated with Thai people for about 5,500 years. Rice has long been Thailand's staple cuisine. Long ago, past to present. As the adage goes, farmers are the backbone of Thailand, and rice production has been their primary employment since ancient times. This illustrates that rice is Thailand's principal economic crop, profitable to export and nourishing our grandparent's children and grandkids. Pathum Thani is another central rice-growing province. Pathum Thani Province has 953,660 farms, 334,851.68 of which are agricultural (35.11%), and 265,062 are rice farms. Pathum Thani Province's main crop is pathumthani fragrant rice (Pathum et al. Office, 2020). A questionnaire revealed that Pathum Thani Province high school pupils are now experiencing the issue. The 16-18-year-old generation is new—most care little about farming and maintaining Thai rice varietals.

Because we have several stimuli, I am worried it will fade if I wait. Thai youth are likewise less interested in agriculture. Traditional education is crucial, but it needs to work on engaging and educating 21st-century students. This section explains the challenges of conventional teaching methods and justifies AR in Thai rice education. Our fast-changing society and education may alter youth learning and behavior. In the 21st century, teachers must prepare students with quality instruction. Change agents like instructors help kids adjust to new learning environments. The survey asked Thai educators about 21st-century education. The study studied 41,991 teachers and educators. A statistical program assessed online questionnaire frequency and percentage data. Findings demonstrated that 21st-century classroom learning and teaching should be done appropriately, although misperceptions of support systems and learning environments were reported. Discussing educators equips students and teachers for modern classrooms (Prachagool et al., P., 2021).

From the background and importance of the above problem, the researcher sees its significance and is interested in developing augmented reality media about Thai rice products for high school students in Pathum Thani Province To enhance their knowledge and develop skills in rice processing through the use of Augmented Reality or AR

technology as a medium for presenting and creating learning. It is also a way to enhance vocational skills for students in response to the indicators of the Basic Education Core Curriculum, BE 2008, Vocational Learning Subject Group Standards. The researcher expects to Develop augmented reality media about Thai rice products. For high school students in Pathum Thani Province, This time, it can be used as a guideline for developing increased reality media in other subjects. Moreover, various formats create a different experience in learning. It helps stimulate learners to have fun with knowledge. Have better academic achievement. Make education management more efficient.

LITERATURE REVIEW

Conventional educational methods, while essential, have several obstacles in engaging and instructing pupils in the 21st century. This section describes some of the challenges traditional teaching techniques face, offering background for using AR in Thai rice education. Passive Learning Paradigm: In traditional classrooms, students receive information rather than actively participate. Textbooks, lectures, and rote memorization hinder hands-on, participatory learning. This one-size-fits-all approach may not accommodate varied learning styles and inhibit critical thinking. Students may struggle to understand abstract or complex concepts, especially those connected to agriculture, without hands-on experience. The Thai rice industry's difficult farming and economics may remain theoretical in traditional contexts. This lack of direct involvement with the material might impair comprehension and engagement. Cultural Disconnect Traditional schooling may need help to transmit Thai rice products' cultural relevance. With immersive experiences and contextual understanding, students can appreciate rice production and consumption of deeply rooted cultural traditions. This can lead to a shallow comprehension that reduces the subject's richness. Disparity in technology has penetrated modern life, yet not all schools have cutting-edge equipment. Inequalities in technology infrastructure and resources can impede creative techniques like augmented reality in education. These issues justify studying other educational methods like augmented reality. This project uses AR technology to make learning about Thai rice products more engaging, immersive, and culturally enriching for upper-secondary pupils. Using augmented reality and gamification in education can benefit students, help educators, improve the educational process, and facilitate the transition to technology-enhanced learning when used student-centered, following proper educational approaches and strategies, and considering students' knowledge, interests, unique characteristics, and personality traits. Students improved their behavior, attitude, and psychology, as well as their engagement, motivation, active involvement, knowledge, focus, curiosity, interest, enjoyment, academic achievement, and learning outcomes. Teachers also praised them. Virtual rewards boosted learning motivation. The necessity for validation tools, design methods, and theories was apparent. Finally, they could provide collaborative and individualized learning and promote students' cognitive and social–emotional development (Lampropoulos et al.; G., 2022).

Augmented Reality (AR): Technology is a component of the Virtual World, such as graphics, 3D videos, animation, and superimposed images in the real world that appear on the display screen. Which is a combination of reality and a created virtual world (Jaithip et al.., 2018). Augmented Reality in Education: AR technology offers dynamic, interactive experiences that combine physical and digital worlds, revolutionizing education. This part introduces AR and reviews educational studies. Augmented Reality (AR) is an immersive technology that adds computer-generated visuals, sounds, and 3D models to the user's real-world surroundings. Unlike virtual reality, which generates synthetic settings, AR adds digital features to the user's surroundings. This mix of virtual and real-world aspects connects students meaningfully with digital content-relevance AR content links dynamically to the learner's environment, giving relevant knowledge and experiences. Interactivity: Students can manipulate and explore AR items in real time. Immersive Engagement AR enhances learners' focus and immersion.

Multisensory Learning AR uses visual, aural, and tactile cues to accommodate different learning methods. Real-World Application AR lets students practice in real-world circumstances. Recent research has examined how AR affects STEM and cultural studies. These studies show that AR can improve learning, engagement, and retention. Previous AR Education Studies: STEM Education AR provides a practical way for pupils to understand complicated scientific concepts like molecular structures and celestial occurrences. History & Cultural Studies AR apps replicate historical settings and artifacts, letting students interact with cultural heritage. Language Learning AR enhanced language learning platforms overlay translations or relevant information on real-world items for contextual language experiences. Skills Training and Simulation AR simulations in healthcare and engineering provide realistic training scenarios without physical resources or surroundings. Geography and Environmental Studies AR can superimpose geographical data on real-world environments for interactive, location-based learning. AR is beneficial to learning and optimal for developing professional abilities in Social Education. Benefits included increasing student learning dynamism, motivation, and interaction; drawbacks included needing to be more inaccessible, requiring prior expertise, and reducing sociability. It can also help with social education in various areas.

In conclusion, AR in university training in this field makes information more dynamic and, naturally, sustainably, creating a highly transferable and inspiring path to content and competency development. AR-based mobile touring systems increased students' memorization more than conventional systems. The proposed system's good influence on students' actualized interest and task-based interest elements is encouraging for outdoor experiences. These experiments imply that AR technology could boost outdoor learning interest and performance. We recommend designing AR virtual objects effectively using an AR-based mobile touring system in authentic learning activities to improve material memory and learning engagement (Chin et al.; C., 2020). Augmented Reality Media: Augmented Reality media uses software and connecting devices like webcams, computers, and other equipment to combine real-world elements with virtual or augmented ones. Computers, smartphones, projectors, and other devices show virtual aspects. Depending on the AR media, these virtual elements can interact with users immediately and be static images, three-dimensional objects, moving images, or multimedia content with audio (Somsak et al.., 2015). The benefits of AR. are that it allows face-to-face learning in the classroom and remotely. Wiwat Meesuwan (2015) says it can adjust information transmission and response between the actual and virtual worlds, raising the natural world's level.

Thai Rice is a civilization that feeds on rice. Rice, a long-standing Thai food crop, symbolizes human society. Rice husks of soil used to produce pottery in Ban Chiang, Non-Nok Tha District, Ban Khok Subdistrict, Phu Wiang, and District provide traces of Thai civilization for at least 5,500 years. It is thought to be Thailand's oldest rice grain. Includes hints of rice grains discovered at Pung Hung Cave. Mae Hong Son. The husks resemble high-altitude large-grain sticky rice. Rice grain hunting is also a desire. Rice chaff marks on pottery and ashes in the soil at Khok Phanom Di Phanat Nikhom District Chonburi Province. It portrays a coastal prehistoric rice-growing village. Evidence includes wild rice flowers in Khao Talu Cave. Kanchanaburi Province, 2,800 years old, is in the late Neolithic-early Metal Era transition. 6,000-year-old cave or stone wall paintings in Pha Mon Noi, Ban Ta Kum, Huai Phai Subdistrict, Khong Chiam District. Ubon Ratchathani. This is like cultivating rice-like cereals. An image of a buffalo sprouting rice-like plants illustrates that humans can produce rice successfully. Thai Rice Exporters Association (2022). The idea for product: Good products drive market success. The products represent consumer aspirations. Products please society. Successful items ensure self-promotion. If they fit consumer wants, they are marketable and should inspire enthusiasm, which matters to market organization. It lets the market decide. Marketers base product meaning on consumer wants. A. Chanchai (2008) Development of products: It takes research, analysis, and design to create creative goods that suit customer needs. Creating new items boosts a company's competitiveness and success. New products can be innovations, adaptations, enhancements, or market entries. Phhalawan Phruekmanee (2015).

Self-learning refers to the process of acquiring knowledge or skills through self-directed learning. With or without the guidance of a teacher. Students establish learning objectives. This study aims to investigate the necessity of solitary studying and discover various available learning resources. Select suitable learning methodologies and assess the outcomes. In 2015, Somkid Issarawat conducted a study. The Basic Education Core Curriculum of 2008, with the 2017 update. The disciplines offered by the Vocational Learning Group aim to provide students with essential life skills and knowledge. It is important to remain conscious of any alterations. The capacity to creatively employ life experiences, professional expertise, and technical knowledge. Compete in Thai and global society. Developing a well-defined career trajectory, cultivating a passion for one's work, and maintaining a positive mindset are crucial to achieving professional success. Experiencing contentment and possessing a sense of self-reliance within societal structures. The Relationship Between Substance Use and Career Outcomes: Acquiring knowledge, proficiency, practical know-how, and adherence to professional principles and standards are essential for comprehending, possessing aptitude, and navigating one's chosen vocation. Leverage technological advancements to enhance professional pursuits while upholding ethical principles and fostering a constructive mentality. According to the Ministry of Education (2017), One crucial factor influencing positive learning outcomes Factors That Influence The engagement of students in various activities and initiatives inside an educational institution. The level of student engagement is crucial in determining the quality of learning outcomes. This section examines the various factors that impact student engagement, specifically emphasizing the role of technology-mediated learning environments in this context. Personalization and cognitive relevance are closely interconnected. Engagement among students tends to develop when they perceive the subject to be pertinent to their interests, aspirations, and prior knowledge. The utilization of technology, namely adaptive learning algorithms and personalized content distribution, allows for the customization of educational experiences to suit the unique needs of individual learners. Consequently, this approach enhances the cognitive relevance of subject matter for students. The concepts of interactivity and participatory education are being discussed. Active participation in the learning process facilitates the enhancement of higher-order cognitive functions and fosters a more profound understanding. Technological-mediated learning platforms, specifically those integrating interactive elements like quizzes, simulations, and collaborative exercises, have been found to enhance critical thinking skills and foster active engagement with the subject matter under study. Providing autonomy and choice

in education entails granting students the authority to govern their learning trajectory and discretion in selecting assignments or projects. This approach has the potential to enhance their level of participation significantly. Technological advancements allow Students to explore subjects that align with their interests and preferred learning modalities. Technology facilitates self-paced learning and grants students access to various educational resources. Timely feedback and assessment are crucial to address misconceptions and encourage learning promptly. Educational technology, such as online quizzes and automatic grading systems, enables students to monitor their progress and promptly make any required modifications. This technology offers immediate feedback to students, facilitating real-time corrections. The concept of multimodal learning experiences refers to using many sensory modalities to acquire knowledge and skills. Providing diverse instructional styles and materials enables educators to cater to the diverse learning preferences of pupils. Technological improvements have facilitated the integration of multimedia elements, such as movies, interactive simulations, and Virtual Reality, into educational settings. Using gamification and rewards in education has created a dynamic and immersive learning environment that engages many students. Incorporating game design elements like points, badges, and leaderboards enhances the educational experience, fostering a competitive spirit and a sense of achievement among students. Gamified aspects integrated into technologically mediated platforms can serve as a means to promote active student engagement and facilitate academic advancement. Additionally, technology can facilitate collaborative learning opportunities, such as through discussion forums, virtual classrooms, and document editing, promoting collaborative engagement and interpersonal cooperation. These opportunities foster community and shared responsibility for educational outcomes. Social interactions with peers can yield valuable perspectives and assistance, enhancing engagement. Understanding the various elements influencing student engagement offers a conceptual foundation for integrating augmented reality into educational environments. The objective of this study is to enhance student engagement in the domain of Thai rice education for students at the upper secondary level. This goal will be accomplished using Augmented Reality (AR) technology's interactive nature, customization capabilities, and multimodal learning opportunities.

METHODS

Population and sample group:
The population of high school pupils at Dipangkornwittayapat (Mattayom et al.) The school served as the subject of this investigation. The total number of students: 369 individuals and the students of Secondary 4 at Dipangkornwittayapat (Mattayom et al.) Under the jurisdiction of the Pathumthani Secondary Educational Service Area Office, the school served as the sample group for this research. There was one classroom with a total of 30 students. The academic year was 2022. Because the room in question will be used for a class on rice during the second semester of the academic year 2022, this information was collected by picking a specific sample, also known as "Purposive Sampling."

Instruments of Research:
(1) An Augmented Reality Media Presentation on Thai Rice Goods Intended for Upper Secondary Students (Grades 10–12). (2) Questionnaire for Upper Secondary Level (Grades 10-12) students seeking the opinions of industry professionals evaluating the quality of augmented reality media on Thai rice products. (3) The pretest and the subsequent test., and (4) An evaluation form for students in Secondary 4 regarding the use of augmented reality media on Thai rice products intended for students in Upper Secondary Level (Grades 10-12).

Data collection:
Collecting data includes researching many concepts, fundamentals, and theories associated with producing augmented reality media. The increased reality material that the researchers generated should be brought to the professionals so that they can review it. To ensure consistency between content, language, questions, teaching activities, and creation aim, consult with measurement and evaluation specialists to determine tool usefulness. Then, make the necessary improvements and corrections to ensure that everything is accurate and comprehensive, just as the recommendations of the specialists suggest in every regard. After that, the augmented reality media was utilized three times with students from schools that were not part of the sample group, including measuring the effectiveness of the students on an individual level. After conducting an efficiency trial with small groups and field testing, the team made adjustments and changes until the product reached an acceptable level of performance. As a result, media based on augmented reality was utilized with the sample population.

Statistics used to analyze data:
(1) Determine whether or not using augmented reality media for marketing Thai rice products at the upper secondary level (grades 10–12) is effective. By applying the equation for calculating efficiency E1/E2 (2), Compare the pretest results with the post-test using a t-test for dependent samples with a significance level of.05 (3) Using the mean and standard deviation (SD.), investigate the contentment children in Grade 4 feel with access to augmented reality media.

FINDINGS

Table 1: Report for upper secondary level (Grades 10-12) totaling 30 people that summarizes the findings of an investigation into the effectiveness of augmented reality media on Thai rice products.

List	Full score	Average score	percentage	Benchmark	E1/ E2
Score during study	50	41.17	82.33	80	82.33
Posttest	20	16.33	81.67	80	81.67

Table 1 shows the results of using augmented reality media on Thai rice products for students in grades 10-12. Then, take the results of the scores from the test that 30 Mathayom 4 students completed. These scores were computed as an average percentage of 82.33, and the mean rate of post-test scores was 81.67. This demonstrates that augmented reality media about Thai rice products is effective. For secondary school pupils in the province of Pathum Thani, it has efficiency according to the requirements of 80/80, which means that E1/E2 is equivalent to 82.33/81.67, which satisfies the assumptions.

Table 2. This study aimed to compare the pretest and post-test performance of students who had learned about Thai rice products from augmented reality media at the upper secondary level (Grades 10–12).

	Full score	Average score	SD.	t	Sig.(2-tailed)
Pretest	20	8.77	2.22	20.96	.00
Posttest	20	16.33	1.45		

As shown in Table 2, the results of applying augmented reality media to Thai rice products at the upper secondary level (Grades 10-12) were as follows: The standard deviation for the pretest was equal to 2.22, and the average score was 8.77. The pupils learned about Thai rice products at the upper secondary level (Grades 10-12) through augmented reality media. After that, the pupils' overall performance on the post-test averaged a zero. The standard deviation is 1.45, the mean value is 16.33, and the t-test analysis before and after the study is 20.96, statistically significant at .05.

Table 3. The following are the findings from an investigation into the extent to which students in grade 4 were satisfied with augmented reality media about Thai rice products intended for students in grades 10-12.

	Evaluation list	$\bar{x}$	SD.	Interpret results
1. Media				
1.1	Clear explanation of media usage	4.48	.50	A lot
1.2	Beautiful and interesting media format	4.52	.50	The most
1.3	Easy to use and easy to learn	4.42	.51	A lot
1.4	The media is appropriate for use in learning	4.32	.55	A lot
	Total average	**4.44**	**.52**	**A lot**
2. Content				
2.1	The content meets the learning objectives	4.45	.50	A lot
2.2	The language used in the lessons is easy to understand	4.39	.55	A lot
2.3	Presentation of content is easy to understand	4.45	.49	A lot
2.4	The amount of content in each story is appropriate	4.48	.56	A lot
2.5	The content arrangement and teaching steps are easy to understand	4.39	.50	A lot
	Total average	**4.43**	**.52**	**A lot**
3. Measurement and evaluation				
3.1	Clarity of questions and answers	4.58	.50	The most
3.2	Appropriateness of the number of assessments	4.52	.47	The most
3.3	Alignment of assessments with content	4.45	.55	A lot
	Total average	**4.52**	**.51**	**The most**
4. Instructional activity organization				
4.1	Encouraging learner engagement in activities	4.61	.48	The most
4.2	Facilitating learning anywhere, anytime	4.61	.53	The most
4.3	Promoting self-directed learning	4.74	.50	The most
	Total average	**4.65**	**.50**	**The most**

Total average	**4.49**	**.51**	**A lot**

According to Table 3, the results of the evaluation of the level of satisfaction that secondary 4 students have towards augmented reality media on Thai rice products for upper secondary level (Grades 10-12) reveal that a total of 30 students have, in general, expressed a high level of satisfaction, with an overall average score of 4.49. They were most pleased with fostering self-directed learning, where they received an average score of 4.74 out of 5. Finding examples of the secondary 4 expressing the least satisfaction was only possible.

CONCLUSIONS AND EVALUATION

The research project on developing augmented reality media for Thai rice products is aimed at upper-secondary students (grades 10–12). Consistent with strategies and promotional activities that let students understand on their own, as well as creating a connection between the ability to self-learn and the ideas presented in the research (Napharat, L., 2017), it is evident that students can indeed acquire knowledge through self-directed learning activities in a variety of subjects. This strategy emphasizes fostering students' natural curiosities and encouraging their natural enthusiasm for learning. According to Sangsawang and Tawang (2015), educators play a critical part in fostering students' capacity for understanding and independent thought by cultivating an atmosphere that encourages acquiring information and insight through self-discovery. As the following examples demonstrate, (1) the explanation of the findings is consistent with the objectives and hypotheses of the research. The usage of augmented reality media on Thai rice goods for upper secondary level (Grades 10-12) students in Thailand involves various important learning activities. This level of education focuses on Thai rice products. These activities include lesson plans, directives, knowledge sheets, activity sheets, and augmented Reality (AR.) supplementary materials that focus on teaching subjects related to the history of rice, rice plant characteristics, rice varieties in Thailand, nutritional content, and dietary aspects of rice, and rice processing. These subject topics correspond to the core curriculum 2008 (Revised Edition 2017). The term "augmented reality" refers to a technology that can combine real-world settings with virtual elements such as photographs, animations, or three-dimensional objects in a seamless manner. As part of their investigation, the academics have produced Augmented Reality (AR) markers that can be scanned using mobile devices like smartphones and tablets. When students point their mobile devices at these augmented reality markers, the screen converts the markers into still images, films, and accompanying noises developed by the course's creators. This strategy promotes learner engagement, enjoyment, and an educational experience that is more captivating, which eventually leads to enhanced learning results. It is crucial, however, to recognize that learning using augmented reality technology may bring difficulties in commencing student activities. It can potentially interfere with the learning process and lead to detours from the goals of the learning experience. The researchers have developed user guides for educators and learners to address this issue. The goal of these manuals is to guarantee that students are adequately prepared before they begin interacting with the augmented reality supplemental resources. These instructions seek to optimize the usefulness of the AR materials while adhering to a set efficiency requirement of 80 percent effective use for each item. According to the research findings, pretest results were conducted before high school students in Pathum Thani Province were introduced to AR supplementary materials to teach Thai rice product subjects. Every one of the thirty students who took the pretest turned in a score that was an average of 8.77 out of a potential 20 points. After finishing the pretest, the researchers presented supplemental AR materials to facilitate self-directed learning activities. The students participated in these activities, made learning activity sheets for each topic, and showed greater interest and passion for learning due to their efforts. Their development was monitored throughout their education, and their average score was computed; the final result was 41.17% out of 50 points. A post-test was given to the students after they had completed the AR supplementary materials and had gained knowledge of Thai rice products. The post-test findings indicated an average score of 16.33 out of 20 points. According to these findings, using AR supplementary resources effectively boosted learning outcomes. The efficiency of these resources reached 82.33 out of 81.67, which is higher than the benchmark of 80 out of 80. Their study focused on constructing digital classes on problem-solving using AR technology for first-year high school students. This research was aligned with the research undertaken by (Supawadee et al.., 2021). The research findings indicated that the AR technology-based digital training on problem-solving displayed an efficacy rating of 81 out of 80.2. The research findings indicate that the learning effectiveness, measured by test scores, improved significantly after augmented reality media on Thai rice products for upper secondary level (Grades 10-12) engaged with AR supplementary materials on Thai rice products. Before the learning process, the students had an average test score of 8.77, with a standard deviation (SD.) of 2.22. After the students had learned through AR supplementary materials, they took a post-learning test, and their average test score increased to 16.33, with a standard deviation (SD.) of 1.44. The statistical analysis, specifically the t-test, comparing the pre-learning and post-learning test scores yielded a significant difference with a t-value of 20.96 at a significance level of .05. This indicates that the improvement in learning outcomes after engaging with the AR supplementary materials is statistically significant. Following the research conducted by (Watcharapol Unjanam., 2020), the study focused on developing AR technology-enhanced media for scouting activities. The research findings revealed that the sample group had

significantly higher learning effectiveness scores after engaging with the AR technology-enhanced media than before the learning process. The statistical significance was observed at a level of .05. (3) The research findings indicate that secondary 4 expressed high satisfaction with using AR supplementary materials on Thai rice products. The average satisfaction score was 4.49, suggesting that the students found the learning materials responsive to their needs, easy to use, and convenient for their learning process. Additionally, the materials were visually appealing, interesting, and aligned with the learning objectives. The AR supplementary materials for Thai rice products helped stimulate students' interest in participating in activities, encouraged them to get hands-on, and challenged them to become more engaged. Furthermore, when students applied their efforts, they achieved immediate success. This level of satisfaction aligns with the research conducted by (Jorinat et al. Apiratitong., 2019), where they studied the development of digital media along with AR technology using cooperative learning techniques (STAD) in the context of sixth-grade computer science classes. Their study found that the sample group expressed the highest level of satisfaction with digital media combined with AR technology, with an average satisfaction score of 4.79.

Recommendations:
Before beginning each teaching and learning session, check that the necessary supplies are available and that there is a connection to the internet. Students should be sufficiently prepared by receiving instruction in AR media tailored to the specific protocols for each stage of the learning activities.

Recommendations for future research:
1. It is recommended that additional studies and studies be carried out on Thai rice to improve the breadth and depth of one's expertise.
2. It is essential to explore the potential of generating AR media for various aspects of Thai rice, including the science and technology involved in rice farming and the production of modern rice products. This will help in the growth and development of this area.
3. To broaden the educational value and impact of AR, consider using AR media for teaching and learning objectives across various topic areas.

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