

Research Article

DEVELOPING ALGORITHMS FOR KNOWLEDGE SYSTEMS DRIVEN BY AI TO SUPPORT PRODUCT DEVELOPMENT IN THAI LOCAL COMMUNITIES

Received: October 8, 2024

Revised: November 27, 2024

Accepted: December 9, 2024

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Abstract

This study explores the implementation of artificial intelligence (AI) algorithms for personalized product development education in Thai rural communities. The research addresses skill deficiencies, promotes economic growth, and enhances educational accessibility through tailored learning experiences. Employing a One-Shot Case Design, the study engaged 50 volunteer participants from the Sop Prap Subdistrict, utilizing surveys, interviews, opinion questionnaires, and competency assessments for data collection. Analysis encompassed descriptive statistics to evaluate the effectiveness of the proposed AI framework. Experimental results showed that: The AI-driven personalized learning approach made education more effective and enjoyable for learners in rural Thai communities. By tailoring the educational experience to each learner's unique needs and preferences, the AI framework improved retention of product development knowledge and skills, ultimately enhancing the quality of locally produced goods. The study's findings suggest that AI-driven personalized learning could be a valuable tool in bridging the skills gap and promoting economic development in rural areas of Thailand.

Keywords: Artificial Intelligence, Algorithm System, Product Development, Local Communities

Introduction

Currently, artificial intelligence (AI) technology is being rapidly developed and applied across various fields. One of the significant benefits of AI is its application in education. Not only in school education systems, but AI technology can also support learning in out-of-school systems, especially providing knowledge to people in local communities for better quality of life and economic conditions. Local communities in Thailand face several challenges. One of them is the lack of knowledge and skills in product development. In fact, products

from local communities play an important role in the Thai economy. These products often have unique identities, reflecting the local culture and wisdom. However, many local community products are still of low quality and unable to compete in the market. The main causes are the lack of necessary technology for producing quality products and the lack of knowledge about product development.

Artificial intelligence (AI) technology is therefore a key enabler for providing local community members with access to technology and knowledge about product development tailored to individual Thai people in local communities. Specifically: 1) Data access - AI can help collect, store, and analyze data about products, markets, and trends. This data can be used to develop educational content that meets the needs of learners in each locality. 2) Personalized learning - AI systems can adapt educational content to suit each individual, considering the learner's knowledge, skills, and experiences. 3) Interactive communication - AI systems can communicate interactively with learners, answering questions, providing guidance, and solving problems learners encounter. 4) Access to knowledge sources - AI systems can connect learners with various knowledge sources such as videos, articles, manuals, and experts. 5) Assessment - AI systems can efficiently assess learners' learning outcomes and track their progress.

In summary, AI technology has the potential to provide Thai people in local communities with convenient, easy, and efficient personalized access to knowledge about product development. This will benefit the development of the local economy, reduce social inequality, and create a sustainable future for local communities in Thailand.

This research focuses on developing an AI algorithm system that can be used to provide knowledge about product development to Thai people in local communities. This system will be designed to be accessible and easy to use, without requiring prior technological knowledge

Objectives

1. Develop the algorithms for knowledge systems powered by AI for the creation of community products.
2. Examine the results of developing algorithms for AI-driven knowledge systems

The Comprehensive Conceptual Foundation

To address the specific requirements of learners and offer a personalized learning experience, we will go deeper into the subject of artificial intelligence technology algorithms in this section, along with their product development knowledge attributes.

The Conceptual Foundation for AI-Driven Personalized Learning.

This overview explores artificial intelligence (AI) algorithms and their application in product development education, particularly for Thai local communities. An algorithm is a step-by-step problem-solving process, named after the 9th-century Persian mathematician al-Khwarizmi (Kurdi, 2017, p.65). Algorithms can be explained using: 1) Pseudocode - simulated code and 2) Flowcharts - diagrammatic representation.

Effective algorithms are systematically planned, clear, unambiguous, consistent with computer processing, and terminate within a specified time (Madi, Issa, Trad, & Madi, 2015, p.70). They have wide-ranging applications, including product recommendations, facial recognition, and gaming.

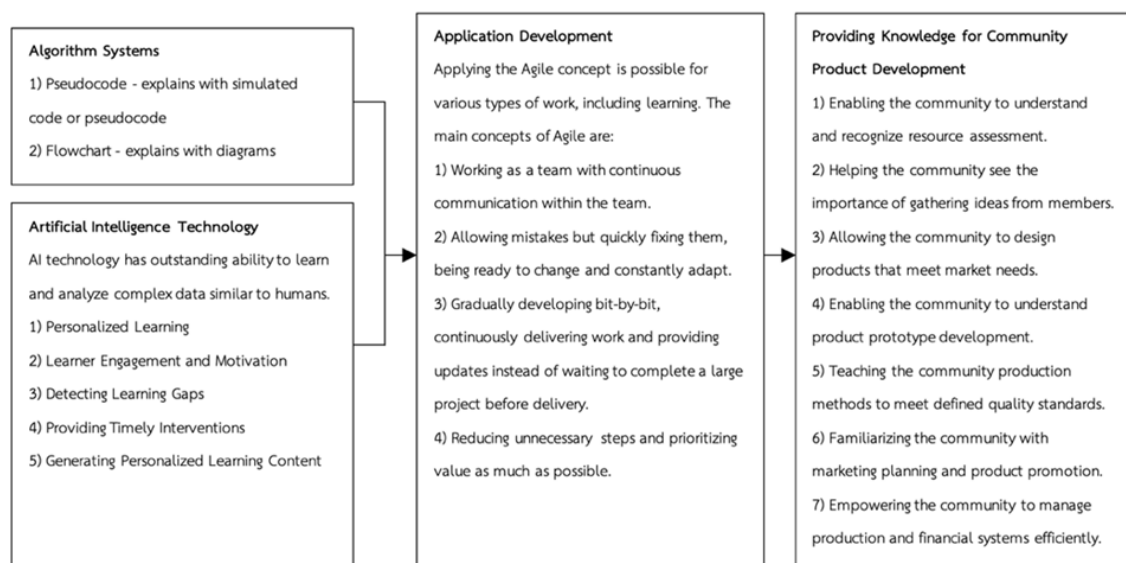
The process of improving locally produced goods and services is known as community product development. It integrates cutting-edge information and technology with indigenous knowledge, skills, and culture ((Phitsamai & Oraphin, 2009, p. 51). Essential elements consist of: Community analysis and resource evaluation; Idea collection from community members; Product design that strikes a balance between community identity and market demands; development and refinement of prototypes; and production techniques that meet quality standards. The system would guide learners through the community product development process, from resource assessment to financial management, while considering local context and individual needs.

AI-driven personalized learning systems offer promising opportunities for enhancing product development education in Thai local communities. By leveraging algorithms, machine learning, and natural language processing, these systems can provide tailored, engaging, and effective learning experiences. However, careful consideration must be given to ethical implications, data privacy, and the balance between AI and human instruction. As technology continues to advance, the potential for AI to transform community-based education and support local economic development grows increasingly significant.

Conceptual Framework

Figure 1

A development of strategic model of artificial intelligence technology algorithms in product development knowledge attributes



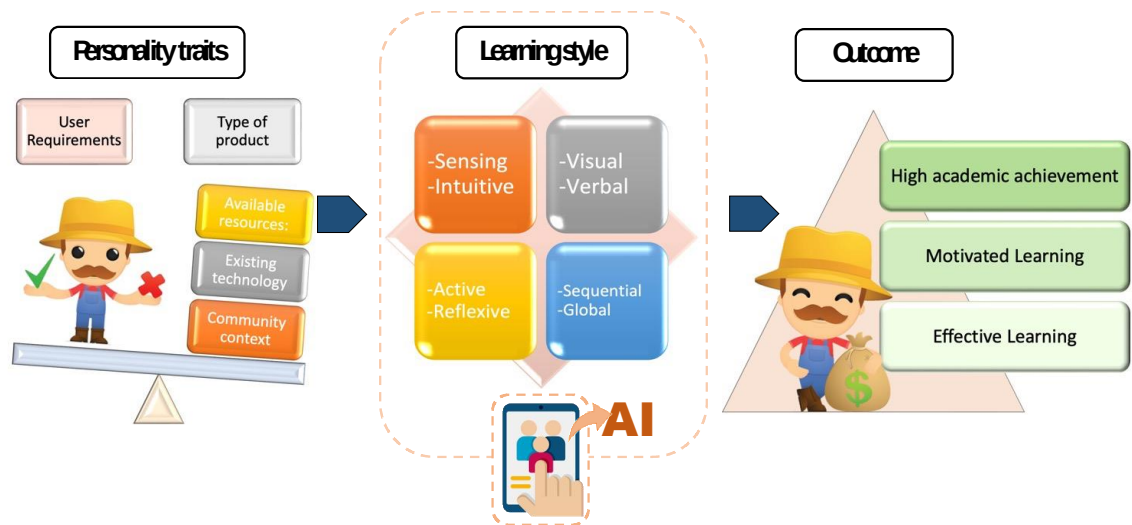
Methodology

The Volunteer Sampling: Sop Prap villagers are the intended audience. Community leaders disseminate the word about the gathering and voluntary application process for research participation. Among the over fifty applicants, those who best fit the target group.

Developing an AI algorithm system for providing product development knowledge to Thai people in local communities is a research and development effort. The main objective is to develop an efficient algorithm system tool for learning that allows learners to access data, learning resources, and learning support conveniently and effectively. It can design learning experiences tailored to each learner's needs and efficiently assess learning outcomes based on the learning context, as follows:

1. Accessing data and learning resources for community members: Search and collect relevant data and learning resources on various topics. Present information in an easy-to-understand format.
2. Personalizing learning for community members: Analyze learners' weaknesses and strengths. Adapt content and teaching methods for each individual learner (self-paced).
3. Supporting learning for community members: Answer questions, explain complex concepts. Provide feedback and suggestions.
4. Encouraging participation for community members: Promote interaction among learners. Motivate learners to want to learn
5. Assessing learning outcomes for community members: Measure learners' knowledge and understanding. Analyze assessment results.

The development of this AI algorithm system for providing product development knowledge to Thai people in local communities places primary importance on defining the characteristics of the input data to the system and the output data from the system. The research by (Luckin & Holmes, 2016, p. 101). highlights that one of the success factors in using AI technology for learning is paying attention to the input data, which should be the individual learner's data, in order to obtain appropriate learning methods as the output, tailored for each specific learner. To access the application, first download the app from the official app store or website. Next, create a user account by entering your email or using social media login. Finally, verify your account and complete the initial profile setup to start using the AI-powered learning system. Figure 2 illustrates this concept.

Figure 2*Concept algorithm system for providing product development knowledge*

In this study, it is an integration of strategies which emphasizes the characteristics of individual learning data as the input data that the AI algorithm must use to format product development learning based on each person's learning style. This is in order to achieve the desired learning outcomes that stimulate and effectively facilitate learning, which is the output data from the system, ultimately leading to successful product development. The methodology is as follows:

1) Study the necessary basic information before developing the AI algorithm system model:

- User needs: Study the needs of villager regarding product development knowledge.
- Product types: The products that need to be developed, problems, obstacles encountered.
- Community context: Study the local community context such as culture, skills, knowledge.
- Available technology: Study the existing technology that accessible in the local community.
- Available resources: Study the available resources such as raw materials, wisdom, equipment.

The study reveals a context of limited technological infrastructure but rich traditional knowledge. Villagers seek economic diversification through skills in product design, particularly in agricultural value-added goods and handicrafts. The AI platform aims to empower local entrepreneurs and transform their innovative potential into marketable products.

2) Approach for developing the AI algorithm system model: From the studied basic information, synthesize an approach for developing the AI algorithm system model as follows:

- Define objectives: Define the objectives of the AI model to achieve the desired outcome of enabling Thai people in local communities to learn about product development and develop design skills and generate new ideas.

- Design the model: Design the AI model to align with the defined objectives and choose appropriate machine learning techniques. Design the model structure, set parameter values, etc.

- Develop the model: Train the AI model on the collected data, evaluate the model's performance, and fine-tune the model for better performance.

- Test and use: Test the AI model with the target groups in local communities, collect feedback, and further develop the model to be suitable for real-world application.

3) Defining the attributes of the system's input and output data by articulating the following attributes of the AI system's content: The system's input data is made up of: User data, including contact details, background, expertise, and knowledge. Product details include product categories, materials, production methods, etc. additional data, such as details regarding laws, technology, etc. Product development knowledge, including concepts, principles, procedures, tools, etc., is contained in the system's output data.

AI can be a crucial tool in developing local community products by helping to analyze markets, design packaging, and improve product quality efficiently. However, a significant challenge is accessing accurate and comprehensive information from remote communities, as well as creating understanding and acceptance of new technology among local producers. Moreover, it is essential to protect traditional wisdom and cultural heritage while introducing modern technological innovations. Striking a balance between innovation and preservation remains a critical consideration that requires careful and thoughtful approach.

Learning styles are characteristics that continuously indicate how learners learn and respond to the learning environment (Felder & Spurlin, 2005, p.105). It has been reported that both personality traits and learning styles have a significant influence on learning (Wolk & Nikolai, 1997, p.9). This approach focuses on considering individual learning styles as a motivating factor. According to this approach, in the next section, we will present an adaptable learning algorithm system that facilitates the dissemination of personalized learning objects. This AI has the potential to increase learners' overall understanding, speed, and learning outcomes.

Results

Providing a chronological explanation of research, covering topics such as research design, research methodology (using algorithms and pseudocode), testing techniques, and data collection (Coffield et al., 2004, p. 76). The following figure and table presentations are cited in the manuscript (Prensky, 2003, p. 21).

1) The result of basic information before developing the AI algorithm system model

Community survey information: This dataset representation of samples, Here's a brief summary of the data. Sex distribution: male: 25 (50%), female: 25 (50%). Age range: 27 to 62 years old. And Education levels: primary school: 12 (24%), lower secondary school: 13 (26%), upper secondary school: 25 (50%). This overview provides a foundation for understanding Product Development. Here are some key points to consider when sharing this knowledge with our sample group of 50 Thai local people (table 1):

Table 1*The results of requirement for product development knowledge among 50 sample*

Topic	Details
Relevance to Local Context:	The principles of product development can be applied to both small-scale local products and larger initiatives. For example, local artisans could use these concepts to develop and market their crafts more effectively.
Emphasis on Customer Needs	The importance of understanding and addressing customer needs is universal and can help local businesses improve their offerings.
Iterative Process	The idea of continually improving products based on feedback is valuable for any scale of business.
Skill Development	Highlighting the various skills involved in product development can encourage lifelong learning and skill acquisition.
Adaptability	While some advanced tools and methodologies might not be immediately applicable, the core principles can be adapted to suit local resources and needs

When utilizing this knowledge to apply the concept of an AI-powered knowledge system for product development in Thai local communities, the following actions should be taken:

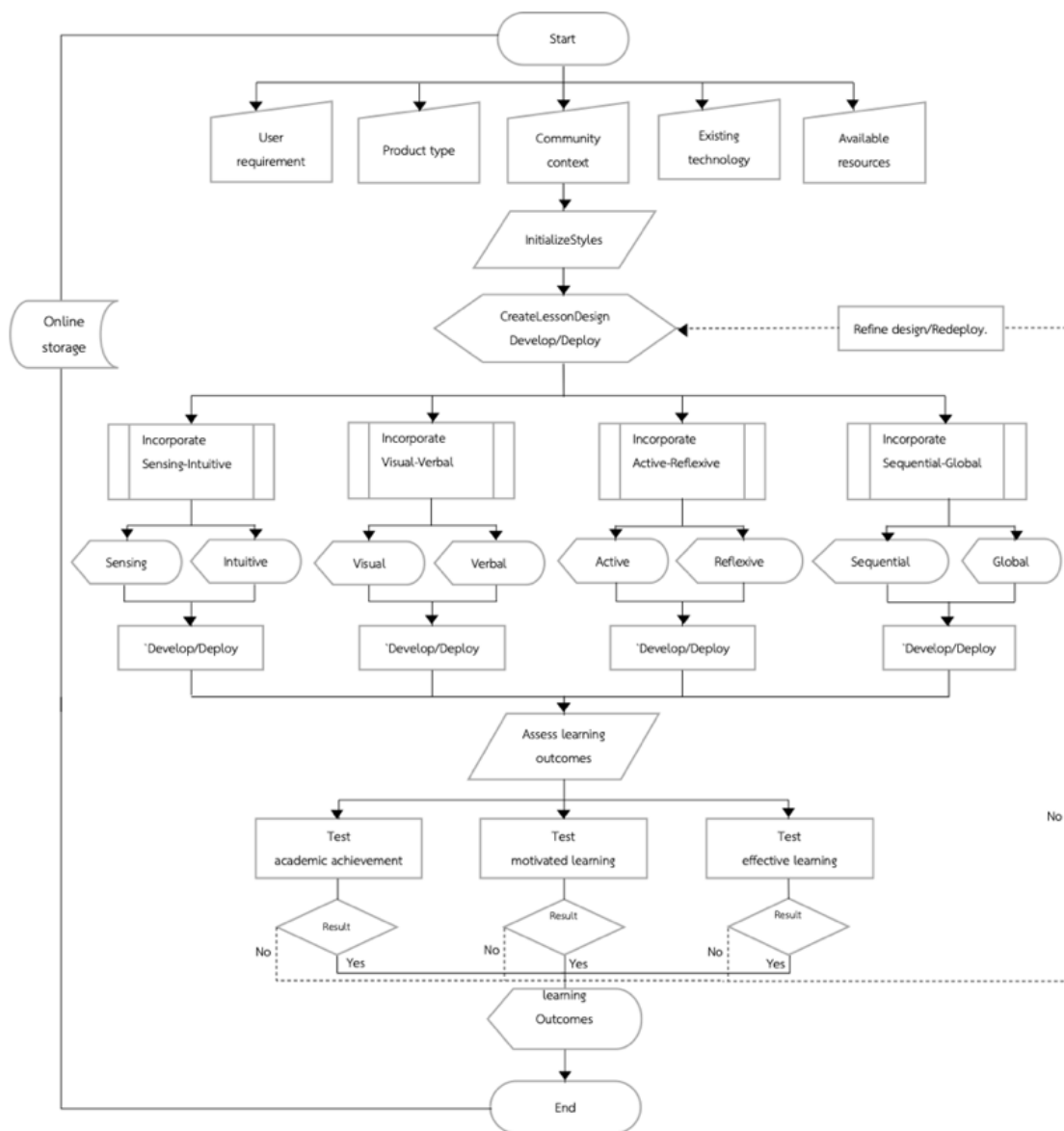
1. Use local examples and case studies to illustrate these concepts.
2. Simplify technical terms and provide explanations in Thai.
3. Focus on aspects that are most relevant to small and medium-sized local businesses.
4. Encourage about how these principles could be applied to improve local products or services.

2) The result of developing the AI algorithm system model

In order to provide Thai people in local communities with information on product development, an artificial intelligence algorithm system that prioritizes input data in order to identify learning styles is being developed. The system's output will be good learning outcomes that encourage learning. An algorithm for incorporating personalized objects that align with the learning styles that act as motivators for students using artificial intelligence technology is shown in Figure 3.

Figure 3

Shows the flowchart of the AI-based models and experimental methods applied



From figure 3 the diagram we have created illustrates various structural models that demonstrate the essential characteristics and operations required for building the system's framework. Within this model. The flowchart (Figure 4) represents the algorithm 'LearnAllLesson' that follows these steps:

Figure 4

Represents the step-by-step instructions of the program according to the algorithm of the flowchart

```

Algorithm LearnAILesson(userRequirements, productType, communityContext,
existingTechnology, availableResources):
    Initialize learningStyles = []
    Initialize learningOutcomes = []

    # Step 1: Analyze inputs to determine learning styles
    learningStyles = AnalyzeLearningStyles(userRequirements, productType, communityContext,
existingTechnology, availableResources)

    # Step 2: Design the AI learning Lesson based on identified learning styles
    LessonDesign = CreateLessonDesign(learningStyles)

    for style in learningStyles:
        if style == "Sensing" or style == "Intuitive":
            # Incorporate Lesson elements catering to Sensing -Intuitive learning styles
            (e.g., hands-on activities, problem-solving challenges)
        elif style == "Visual" or style == "Verbal":
            # Incorporate Lesson elements catering to Visual -Verbal learning styles (e.g.,
            visual aids, narrations, interactive dialogues)
        elif style == "Active" or style == "Reflexive":
            # Incorporate Lesson elements catering to Active -Reflexive learning styles
            (e.g., interactive simulations, reflective exercises)
        elif style == "Sequential" or style == "Global":
            # Incorporate Lesson elements catering to Sequential -Global learning styles
            (e.g., structured progression, overarching concepts)

    # Step 3: Develop and deploy the AI learning Lesson
    Lesson = DevelopLesson(LessonDesign)
    DeployLesson(Lesson)

    # Step 4: Assess and refine the learning Lesson to achieve desired outcomes
    LearningOutcomes = AssessLearningOutcomes(Lesson)
    while not (AchievedHighAcademicAchievement(LearningOutcomes) and
AchievedMotivatedLearning(LearningOutcomes) and
AchievedEffectiveLearning(LearningOutcomes)):
        LessonDesign = RefineLessonDesign(learningStyles, learningOutcomes)
        Lesson = UpdateLesson(LessonDesign)
        DeployLesson(Lesson)
        LearningOutcomes = AssessLearningOutcomes(Lesson)

    return learningOutcomes

```

1. Initialize the 'learningStyles' and 'learningOutcomes' lists.
2. Analyze the inputs (user requirements, product type, community context, existing technology, and available resources) to determine the relevant learning styles using the 'AnalyzeLearningStyles' function.
3. Create the Lesson design based on the identified learning styles using the 'CreateLessonDesign' function. The AI implementation to accommodate several learning styles:

3.1 Sensing vs. Intuitive Learners: Sensing (majority in rural Thailand): Prefer concrete, practical information. AI Example: When a villager is learning about packaging, it shows real-life examples from successful local businesses. "Like Ratree's sour pork, you can use banana leaves for a natural, eco-friendly wrap.

3.2 Visual vs. Verbal Learners: Visual (very common in Thai communities): Learn best through pictures, diagrams. AI working example: Teaching pricing, it displays a colorful chart comparing a villager's bamboo basket prices to market rates, with size indicating profit margin.

3.3 Active vs. Reflective Learners: Active (prevalent in communal settings): Learn by doing and discussing. AI working example: In a marketing lesson, it prompts, "You have 2 minutes to rearrange your virtual stall. Then, we'll have your neighbors (other online players) vote on the appeal.

3.4 Sequential vs. Global Learners: Sequential: Learn in linear steps. AI working example: Teaching online sales, it guides: "Step 1: Photograph your bamboo basket. Step 2: Write description. Step 3: Set price." Each step is locked until the previous is completed.

4. Incorporate Lesson elements that cater to each identified learning style (Sensing-Intuitive, Visual-Verbal, Active-Reflexive, and Sequential-Global).

5. Develop and deploy the AI learning Lesson using the `'DevelopLesson'` and `'DeployLesson'` functions, respectively.

6. Assess the learning outcomes using the `'AssessLearningOutcomes'` function.

7. Check if the desired learning outcomes (high academic achievement, motivated learning, and effective learning) have been achieved by calling the respective functions (`'AchievedHighAcademicAchievement'`, `'AchievedMotivatedLearning'`, and `'AchievedEffectiveLearning'`).

8. If the desired outcomes are not achieved, refine the Lesson design using the `'RefineLessonDesign'` function, update the Lesson with the new design using the `'UpdateLesson'` function, and redeploy the Lesson using the `'DeployLesson'` function. Then, reassess the learning outcomes.

9. If the desired outcomes are achieved, return the `'learningOutcomes'`.

The AI-based personalized learning algorithm collects user and product data, determines individual learning styles, and delivers tailored product development lessons. It covers key concepts, processes, and tools while adapting content to each learner's preferences, aiming to enhance motivation, engagement, and learning outcomes in product development education. The learning objects/lessons cover knowledge about product development concepts, principles, processes, tools, recommendations on development methods, design, idea generation, and sources of information. The algorithm outlined (represented by the flowchart in Figure 5 below) aims to adapt the lesson delivery and content to each individual's learning style preferences, leveraging AI to enhance motivation, engagement, and learning effectiveness for product development knowledge among the target learners.

Figure 5

Shows the flowchart TD of two algorithms Develop and Deploy

```

Algorithm DevelopLesson(LessonDesign):
  Initialize Lesson

  # Step 1: Set up the Lesson environment
  LessonEnvironment = SetUpLessonEnvironment(LessonDesign.environment)
  Lesson.environment = LessonEnvironment

  # Step 2: Create Lesson characters and entities
  LessonCharacters = CreateLessonCharacters(LessonDesign.characters)
  LessonEntities = CreateLessonEntities(LessonDesign.entities)
  Lesson.characters = LessonCharacters
  Lesson.entities = LessonEntities

  # Step 3: Implement Lesson mechanics
  Lesson.mechanics = ImplementLessonMechanics(LessonDesign.mechanics)

  # Step 4: Develop Lesson levels and challenges
  LessonLevels = DevelopLessonLevels(LessonDesign.levels)
  Lesson.levels = LessonLevels

  # Step 5: Integrate learning content
  IntegrateLearningContent(Lesson, LessonDesign.learningContent)

  # Step 6: Develop user interface and controls
  Lesson.userInterface = DevelopUserInterface(LessonDesign.userInterface)
  Lesson.controls = DevelopControls(LessonDesign.controls)

  # Step 7: Implement AI components
  Lesson.AI = ImplementAIComponents(LessonDesign.AI)

  # Step 8: Conduct playtesting and refinement
  PlaytestLesson(Lesson)
  RefineLesson(Lesson)

  return Lesson

Algorithm DeployLesson(Lesson):
  # Step 1: Prepare Lesson for deployment
  PrepareLessonForDeployment(Lesson)

  # Step 2: Deploy Lesson on target platforms
  for platform in Lesson.targetPlatforms:
    DeployLessonOnPlatform(Lesson, platform)

  # Step 3: Monitor and maintain the Lesson
  MonitorLessonPerformance(Lesson)
  PerformLessonUpdates(Lesson)

```

In Figure 5 the flowchart represents two algorithms: 'DevelopLesson' and 'DeployLesson'.

The 'DevelopLesson' algorithm follows these steps:

1. Set up the Lesson environment using the 'SetUpLessonEnvironment' function and assign it to the Lesson's environment. The purpose to creates the virtual world or setting where the lesson takes place, Example in type of product lesson, it might create a 3D model of Thai local environment.
2. Create Lesson Characters and Entities using the 'CreateLessonCharacters(LessonDesign.characters)' and 'CreateLessonEntities(LessonDesign.entities)' function and assign them to the Lesson's characters and Lesson's entities. The Purpose to generates interactive characters e.g Generates characters like Mae Fong, a respected cotton weaver, or Khun Tongbai, a successful wood furniture maker. Entities include traditional looms, wooden bed, and local raw materials like Teak and cotton trees.
3. Implement Lesson mechanics using the 'ImplementLessonMechanics(LessonDesign.mechanics)' function and assign them to the Lesson's mechanics with the purpose to sets up the rules and systems that govern how the lesson operates. Example: Introduces a "Quality and Innovation" system. Villagers earn "Craft Points" for maintaining traditional techniques and "Innovation Points" for adapting designs to modern tastes, teaching balance between heritage and market demands.

4. Develop Lesson levels and challenges using the `'DevelopLessonLevels(LessonDesign.levels)'` function and assign them to the Lesson's levels. Purpose to create different stages or puzzles that progressively teach concepts. Example: Limitations of raw materials or unexpected changes in customer demand content into the Lesson using the `'IntegrateLearningContent'` function.

5. Integrate Learning Content using the `'IntegrateLearningContent(Lesson, LessonDesign.learningContent)'` with the purpose to embeds educational material into the game's narrative, visuals, or challenges. Example: When villagers select fabrics in Mae Fong's workshop, she shares knowledge about sustainable sourcing. In Khun Thongbai's studio, dialogues cover topics like ergonomic design principles, blending tradition with modern comfort bed.

6. Develop User Interface and Controls using the `'DevelopUserInterface(LessonDesign.userInterface)'` and `'DevelopControls(LessonDesign.controls)'` The Purpose were to creates menus, buttons, and input methods for villagers interaction, Example: Designs an intuitive Thai-language interface with visual cues familiar to rural users, like temple art motifs. Controls mimic real-life actions—swiping to weave, tapping to shape wood pattle making it intuitive for artisans.

7. Implement AI Components using the `'ImplementAIComponents(LessonDesign.AI)'` to adds intelligent features like adaptive difficulty or personalized feedback, Example: AI analyzes a villager's crafted products, offering personalized tips. If a basket weaver's designs aren't selling well, AI suggests combining traditional patterns with trendy colors based on current Bangkok fashion trends.

8. Conduct Playtesting and Refinement using the `'PlaytestLesson(Lesson)'` and `'RefineLesson(Lesson)'` to tests the lesson with real users, then adjusts based on their feedback, Example: AI is tested with artisans in Lampang's Mae Tha pottery village. Feedback shows they struggle with e-commerce levels. In response, developers simplify online selling mechanics and add tutorials featuring real Thai Etsy success stories.

After creation, the lesson is deployed:

8.1 Prepare Lesson for Deployment using the `'PrepareLessonForDeployment(Lesson)'` to packages the lesson for distribution, ensuring compatibility. Example: Compressing files, checking for platform-specific issues.

8.2 Deploy Lesson on Target Platforms using the `'DeployLessonOnPlatform(Lesson, platform)'` in a loop to releases the lesson on each intended platform (e.g., Windows, iOS) For example: Uploading to Steam for PC users and the App Store for iPhone users.

8.3 Monitor and Maintain the Lesson using the `'MonitorLessonPerformance(Lesson)'` and `'PerformLessonUpdates(Lesson)'` to tracks usage data to spot issues, then updates the lesson For example: If many users quit at a certain level, that level is patched to be easier.

This algorithm provides a structured approach to creating engaging, educational AI lesson games. It ensures that learning content is well-integrated into an interactive, fun environment, making education more effective and enjoyable. While the algorithms provide a high-level structure, several aspects require further consideration: implementation of effective learning style analysis techniques, collaboration between

instructional designers, educators, and subject matter experts to create high-quality lesson content [8], incorporation of advanced AI techniques for adaptive learning and personalization (Lester, Spires, Nietfeld, Minogue et al., 2014, p. 9) playtesting and iterative refinement based on user feedback and data [10], deployment and maintenance strategies tailored to target platforms (Zackariasson & Wilson, 2012, p. 77) and designing for scalability and adaptability to evolve with technology and learning needs (Squire, 2008, p. 23). Successful implementation relies on multidisciplinary expertise, iterative development, and understanding of the target learners. The algorithms serve as a foundation to be expanded upon.

The result of Test and use

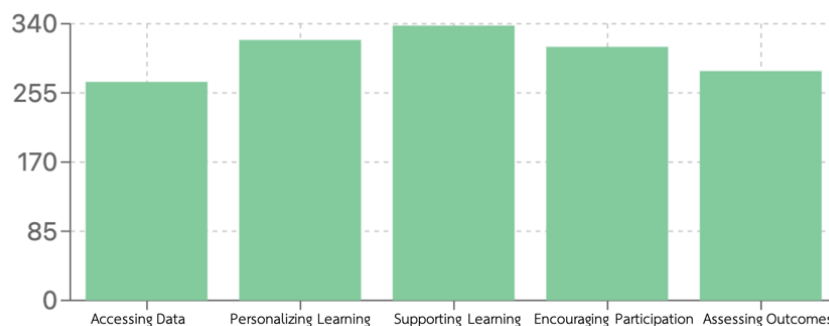
Three experts with different areas of expertise were consulted during the experimental and implementation procedures: a data scientist, an educational psychologist, and a learning technology specialist. Revisions were made, and the system was then applied to a sample of 50 people. These are the outcomes:

1) Expert examination results.

This multi-disciplinary analysis provides a comprehensive view of the learning support initiatives, combining insights from technology, psychology, and data science to offer a holistic understanding of the system's performance and potential improvements. The results are shown in Figure 6.

Figure 6

A bar chart to visualize the weighted scores from three experts



All experts recognized strengths in personalization and learning support. They identified data access and outcome assessment as areas for improvement. Each expert emphasized the need for more consistent user experiences across all aspects of the learning support system. All three suggested leveraging successful strategies from high-performing areas to improve others.

2) Experiment results.

This study evaluated five key aspects of learning support initiatives: Accessing Data, Personalizing Learning, Supporting Learning, Encouraging Participation, and Assessing Outcomes. The survey collected responses from community members using a 5-point scale to measure effectiveness in each area. The table

shows a sample data collection from 50 respondents using a 5-point Likert scale, where: 1 = Strongly Disagree/Very Poor, 2 = Disagree/Poor, 3 = Neutral/Average, 4 = Agree/Good, 5 = Strongly Agree/Excellent

Table 2

The *results* of requirement for product development knowledge among 50 sample

Areas	N	M	Median	Mode	SD	SD ²	C.V.
<i>Accessing Data</i>	50	3.71	4	4	1.030	1.061	27.73%
<i>Personalizing Learning</i>	50	4.10	4	4	0.900	0.810	21.95%
<i>Supporting Learning</i>	50	4.20	4	5	0.823	0.677	19.60%
<i>Encouraging Participation</i>	50	3.98	4	4	0.785	0.616	20.13%
<i>Assessing Outcomes</i>	50	3.7	4	4	0.881	0.776	23.81%

Overall Trends from table, the data reveals a generally positive perception of the learning support initiatives, with mean scores ranging from 3.7 to 4.2 out of 5. This suggests that participants are largely satisfied with the current systems and approaches, though there is some variation in effectiveness across different areas. Category-specific Insights:

Accessing Data: With a mean of 3.714, median and mode of 4, this category shows generally positive results. However, the highest coefficient of variation (CV) at 27.73% indicates the most variability in responses among all categories. This suggests that while many find data access satisfactory, experiences are not consistent across all users.

Personalizing Learning: A mean of 4.1 and CV of 21.95% indicate that personalization efforts are well-received with moderate variability. The estimated median and mode of 4 suggest most participants find the personalization effective.

Supporting Learning: This category shows the highest mean (4.2) and lowest CV (19.60%), indicating that support mechanisms are consistently effective across the community. This points to a uniformly positive experience in learning support.

Encouraging Participation: With a mean of 3.9 and CV of 20.13%, efforts to encourage participation seem successful and fairly consistent. This suggests that engagement strategies are working well for most participants.

Assessing Outcomes: The lowest mean (3.7) and second-highest CV (23.81%) suggest that assessment practices may be an area for improvement. The higher variability indicates inconsistent experiences or perceptions of assessment methods.

Discussions

The proposed algorithm provides a comprehensive framework for developing and deploying AI-based personalized learning lessons tailored to the learning styles of individuals in Thai local communities. The approach emphasizes the importance of input data such as user information, product information, and relevant contextual data to determine the appropriate learning styles (Kinshuk, & Liu, 2009, p.6). By aligning the lesson design and content with the identified learning styles (Sensing-Intuitive, Visual-Verbal, Active-Reflective, and Sequential-Global), the algorithm aims to enhance learner understanding, engagement, motivation, and overall learning outcomes (Truong, 2016, p. 1189).

The algorithm incorporates various steps, including analyzing inputs, creating lesson designs, implementing lesson mechanics, developing levels and challenges, integrating learning content, and conducting playtesting and refinement. These steps align with established instructional design models and best practices for developing effective educational technologies (Burd et al., 2015, p. 261). Additionally, it considers the deployment process, including preparing the lesson for distribution, deploying it on target platforms, and monitoring and maintaining the lesson based on usage data (Klasnja-Milicevic et al., 2011, p. 898). The proposed approach leverages AI components to provide personalized feedback, adaptive difficulty, and tailored recommendations based on learners' interactions and progress (Khamparia & Pandey, 2017, p. 221). By adapting the lesson delivery and content to individual learning style preferences, the algorithm leverages the potential of AI to enhance the effectiveness and enjoyment of educational experiences for product development knowledge among the target learners in Thai local communities (Latham et al., 2014, p. 105). Overall, this algorithm offers a structured methodology for creating engaging, educational AI-based lessons that seamlessly integrate learning content into an interactive and immersive environment, making education more effective for learners in Thai communities (Hu, Chu, Ng, & Kirse, 2018, p.324).

Recommendations

1. Recommendations for applying the research results

- 1.1 Enhance data accessibility. Provide training sessions for users struggling with data access.
- 1.2 Improve outcome assessment by develop a more robust, multi-faceted assessment system that provides timely, constructive feedback aligned with individual learning goals.

2. Recommendations for future research

- 2.1 Conduct a long-term study to track how personalized learning paths affect student outcomes over time.
- 2.2 Investigation of data accessibility barriers such as conduct in-depth interviews and observational studies to understand the specific challenges users face when accessing data, particularly focusing on the factors contributing to the high variability in user experiences.

2.3 To improve reliability and enable wider implementation, there is place for improvement in terms of broadening the target group and carrying out long-term evaluations.

References

- Burd, E. L., Drummond, S. A., & Hogge, B. (2015). Deployment of an integrated gaming and multimedia environment for academic learning. *Journal of Educational Technology Systems*, 43(3), 259-276.
- Coffield, F., Moseley, D., Hall, E., & Ecclestone, K. (2004). *Learning styles and pedagogy in post-16 learning: A systematic and critical review*. London: Learning and Skills Research Centre.
- Felder, R. M., & Spurlin, J. (2005). Applications, reliability and validity of the index of learning styles. *International journal of engineering education*, 21(1), 103–112.
- Hu, X., Chu, S. K. W., Ng, W., & Kirse, G. (2018). An immersive learning system using Kinect for computer science education. *Proceedings of the 49th ACM Technical Symposium on Computer Science Education*, 49, 324-329.
- Khamparia, A., & Pandey, B. (2017). Knowledge and intelligent computing methods in e-learning. *International Journal of Technology Enhanced Learning*, 9(2), 221-242.
- Kinshuk, S. G., & Liu, T. C. (2009). Supporting teachers in identifying students' learning styles in learning management systems: An automatic student modelling approach. *Journal of Educational Technology & Society*, 12(4), 3-14.
- Klasnja-Milicevic, A., Vesin, B., Ivanovic, M., & Budimac, Z. (2011). E-learning personalization based on hybrid recommendation strategy and learning style identification. *Journal of Computers & Education*, 68(3), 885-899.
- Kurdi, M. Z. (2017). *Natural language processing and computational linguistics 2: Semantics, discourse, and applications*. Oxford: John Wiley & Sons.
- Latham, A., Crockett, K. & McLean, D. (2014). An adaptation algorithm for an intelligent natural language tutoring system. *Journal of Computers & Education*, 71(1), 97-110.
- Lester, J. C., Spires, H. A., Nietfeld, J. L., Minogue, J., Mott, B. W., & Lobene, E. V. (2014). Designing game-based learning environments for elementary science instruction: A narrative-centered learning perspective. *Information Sciences*, 264, 4-18.
- Luckin, R., & Holmes, W. (2016). *Intelligence Unleashed: An argument for AI in Education*. London: UCL Knowledge Lab.
- Madi, T., Issa, H. A., Trad, E., & Madi, K. (2015). Artificial Intelligence for Speech Recognition Based on Neural Networks. *Journal of Signal and Information Processing*, 6(1), 66-72.
- Pagulayan, R. J., Steury, K., Fulton, B., & Romero, R. L. (2005). Designing for fun: User-testing case studies, *Springer*, 4(2), 137-161.

Phitsamai, S., & Oraphin, S. (2009). Approaches to Developing Community Products for the Global Market.

Journal of Humanities and Social Sciences Research, 7(1), 42-53.

Prensky, M. (2003). Digital game-based learning. *Computers in Entertainment (CIE)*, 1(1), 21-28.

Squire, K. (2008). *Open-ended video games: A model for developing learning for the interactive age*. United States: MIT Press.

Truong, H. M. (2016). Integrating learning styles and adaptive e-learning system: Current developments, problems, and opportunities. *Computers in Human Behavior*, 55, 1185-1193.

Wolk, C., & Nikolai, L. A. (1997). Personality types of accounting students and faculty: Comparisons and implications. *Journal of Accounting Education*, 15(1), 1-17.

Zackariasson, P., & Wilson, T. L. (2012). *The video game industry: Formation, present state, and future*. London: Routledge.