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A PROPOSED WORKFLOW TO FOSTERING ACADEMIC TEACHING PRACTICES USING GENERATIVE AI CHATBOTS: MARINE ELECTRIFICATION AS A GUIDE COURSE EXAMPLE

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ABSTRACT

This paper proposes a systematic workflow for integrating generative AI Chatbots into academic teaching practices. The "Marine " course has been employed as an example guide to verify the generic framework and then explore this integration's potential benefits and challenges. The proposed workflow is divided into four sub-frames; Before-Teaching, During-Teaching, After-Teaching and finally Keep-Connecting. For each frame, guided prompt examples are demonstrated; facilitating the effectiveness of this approach not only in the context of the given course but also can be tailored for any other academic courses. A list of suggested guidelines for educators to leverage the proposed approach is also introduced. This work aims to contribute to the recent development of best practices to utilize generative AI to provide insights into effective pedagogical approaches to enhance academic staff teaching experiences.

Keywords: Academic Teaching, AI-Powered Chatbots, Marine Electrification, Framework

1. INTRODUCTION

Teaching, learning, and research processes have the potential to be greatly enhanced and transformed by the incorporation of AI-powered chatbots into academic activities. Guidelines for the responsible implementation of deployments have been introduced in [1]-[6].

Since Chabot provides a number of benefits in academic settings, including individualized adaptive learning experiences, help for skills development, and round-the-clock assistance, several researchers have recommended it for use in academic education. [7]-[10].

However, there may be ethical issues with data privacy, bias, and transparency in such technology dependance. These issues could also include the need for clear guidelines and careful selection based on particular academic requirements in order to be responsibly integrated and used [11]-[14].

The integration of such technologies in academic environments has been guided by a number of frameworks and models, including examples of best practices [15]-[19].

Nonetheless, it has been noted that in order to highlight the advantages and minimize the drawbacks of utilizing this accelerated technology and tools in an academic teaching environment, it is still imperative that a systematic framework and detailed instructions for each activity of academic practices should be more developed.

Therefore, this paper contributes to that field by proposing a systematic methodology to facilitate the integration of generative AI chatbots into academic teaching techniques. It does this by presenting a four-stage workflow guidance that is paired with guided prompt examples for further clarity. A set

of challenges and practices rules have been also finalized. The "Marine Electrification" course has been considered as a guide teaching course for proposal clarification.

The paper is organized into eight sections including; introduction, teaching styles, selecting the AI-powered catboats, marine electrification technologies, proposed framework for supporting educators teaching activities, suggested leveraging rules, and finally conclusions.

2. TEACHING STYLES

Teaching can be defined as "giving lessons about a particular subject to a group of learners". Recently teaching styles, as depicted in Figure 1, can be categorized mainly based on: [20]

Teacher-Centered Approach, as the teacher plays the main role in the learning process, while students are often passive learners, primarily listening and absorbing information.

Student-Centered Approach, where teachers with their authority share students' focus and cooperation to interact equally for more student inquiries and active learning purposes.

The proposed approach in this paper is trying to provide an assist tool to the academic educators in their teaching process for more activities toward student-centered and active learning styles.

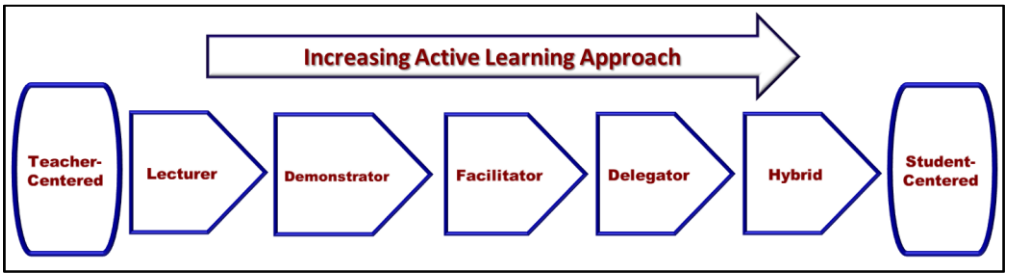

Figure 1: Different Teaching Styles

3. SELECTING THE AI-POWERED CHATBOTS

A Generative AI Chatbot can be defined as a computer program that uses artificial intelligence to have conversations with people and create new text, images, or other content based on what it has learned and what they are asking about.

A variety of AI-powered Chatbots (mainly designed for conversation and interaction) and facilitating tools (focus on helping and creating original content in various formats) together with specific platforms (particularly designed to assist teachers in various aspects of their work) have been recently developed and introduced for personal individual use through the internet accounts and also with available mobile phone applications store. Selecting the right AI-powered chatbot or tool for teaching requires careful consideration and critical factors; such as the need for educational focus, ease of use, content style, ability to create engaging content, and accuracy of information. Additionally, it's essential to balance the possible required cost with the potential benefits for the educator's final targets. Figure 2 depicts some of such useful and available AI-powered chatbots, tools and platforms.

Figure 2 : Examples of Available AI-Powered Chatbots, Tools and Platforms

Guide Prompt Examples:

It is recommended to start working with AI-Powered chatbots by asking to provide a short comparison of the available Chatbots, tools and platforms, for better understanding of each feature and facility; as the following guided prompts:

- *"Give me a short comparison between ChatGPT, Gemini, and Copilot for academic teaching activities"*
- *"Suggest two AI-powered tools to convert text-to-image, text-to-presentation, and text-to-video"*
- *"Compare between Teachy and Google Classroom platforms"*

4. MARINE ELECTRIFICATION

Marine electrification is the process aiming to transitioning marine systems, particularly for vessels, from traditional fossil fuel-based propulsion to fully-electric or hybrid-electric technology. This shift is driven by increasing environmental concerns, stricter emissions regulations, reliable performance and the potential for cost savings [21]. Key technologies driving such marine electrification can be depicted as in figure 3. This subject will be considered as a guide course for prompt clarification

examples given within each sub-section of the proposed workflow, as will be demonstrated in section 6.

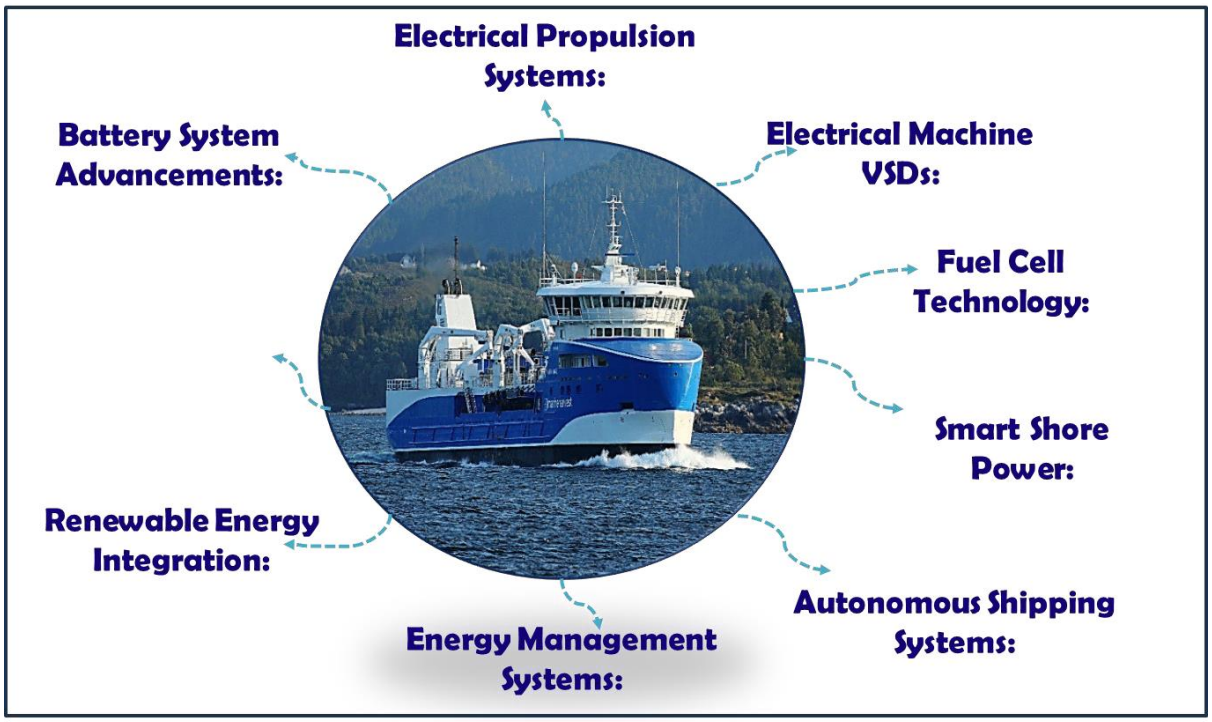

Figure 3: Marine Electrification Key Technologies

5. PROPOSED FRAMEWORK FOR SUPPORTING TEACHING ACTIVITIES

As illustrated in Figure 4, the author suggests a workflow framework consists of four sub-frames to effectively use the available chat tools in different stages of education activities. Each stage with guide prompt examples related to marine electrification course will be illustrated in the following subsections.

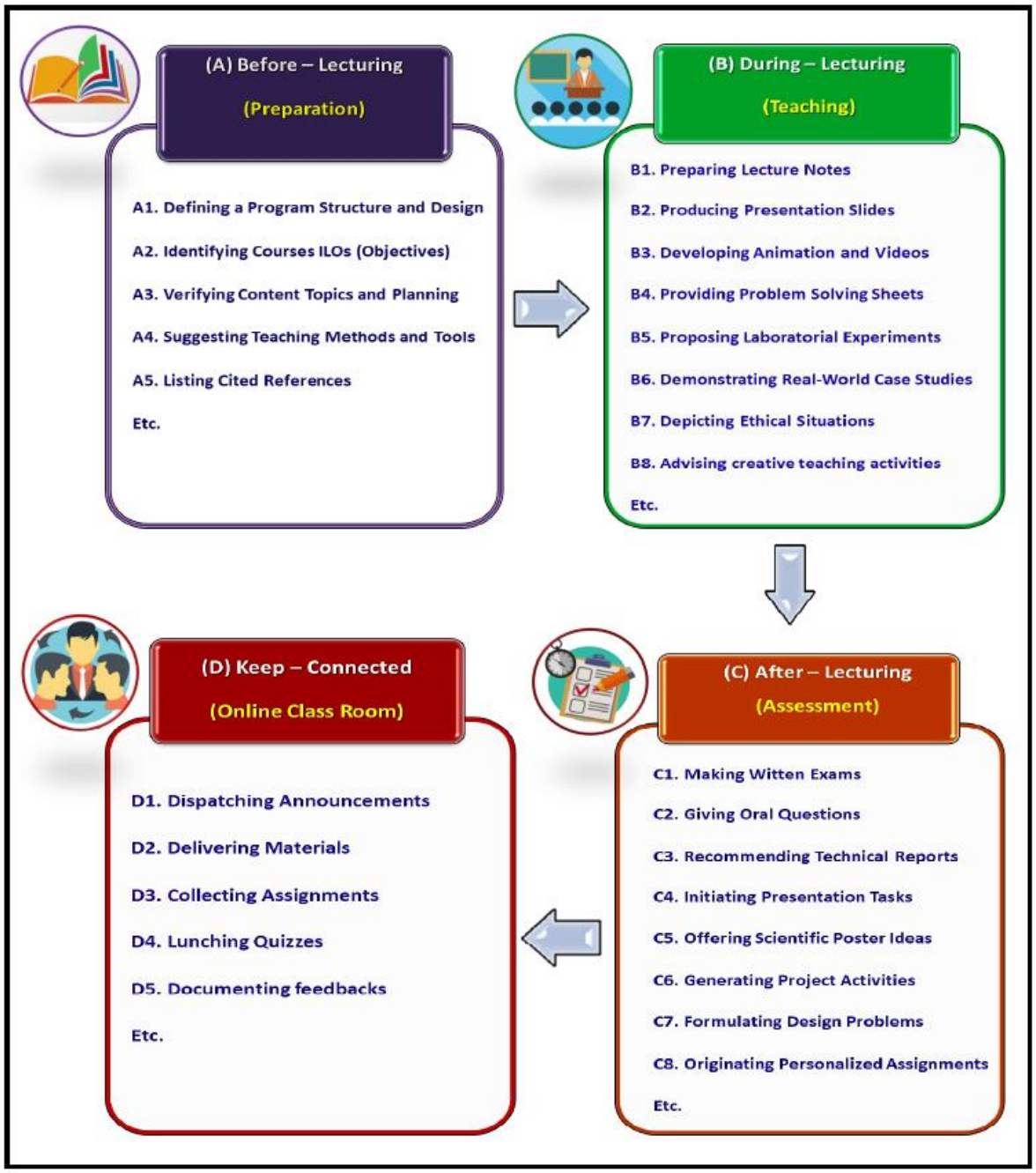

Figure 4: The Proposed Four-Stage Workflow Leveraging Generative AI in Academic Teaching

A. Before –Lecturing (Preparation) Stage

This first stage is important for the educator particularly if new courses or possible new programs, need to be developed. Chatbots can then effectively assist in the following preparation activities:

A1. Defining a Program Structure and Design: can provide suggestions for suitable courses with sequences, credit hours' distribution, and overall program coherence based on standards and institutional goals.

A2. Identifying Course ILOs (Objectives): can help educators create clear and measurable learning outcomes aligned with program goals, ensuring that students develop the necessary skills, knowledge and attitudes.

A3. Verifying Content Topics and Planning: can assist in researching and validating course content, suggesting relevant topics, and providing information on current trends and developments in the given field.

A4. Suggesting Teaching Methods and Tools: can offer recommendations for effective teaching strategies, including lectures, discussions, group work, and technology-enhanced learning tools, based on the course objectives and student needs.
A5. Listing Cited References: can guide educators find relevant scholarly sources, books and sites, organize bibliographies, and ensure proper citation formatting according to academic standards.
Guide Prompt Examples:
Typical prompt examples for proper utilization of the proposed sub-frame **A. Before-Lecturing (Preparation)** stage are listed as follows: (for **Marine Electrification** as a guide course).

A1. "Define a program structure and design for a new department minor track regarding marine electrification"

A2. "Identify ILOs (objectives) for a proposed course on marine automation and control systems"

A3. "Verify 15 weeks' content topics and planning for a proposed course on introduction to marine electrification technologies"

A4. "Suggest teaching methods and tools for a proposed course on power converters for marine applications"

A5. "List cited references including books and best practices for a novel course on marine energy storage systems"

B. During – Lecturing (Teaching) Stage
This second stage can be considered as the core of the educator effort during the teaching process to effectively facilitate the course contents. Chatbots can enhance various facilities during lecturing including the followings activities:
B1. Preparing Lecture Notes: can provide outlines, offer summaries and explanation of key points, and suggest additional research topics.
B2. Producing Presentation Slides: can create initial drafts, offer design layout, suggest illustrations, and even refine slide content based on given topics.
B3. Developing Animation and Videos: can write scripts, assist with editing and suggest visuals, tools, platforms or sites suitable for creating or getting related educational animations and videos.
B4. Providing Problem Solving Sheets: can generate questions, provide solutions, and suggest relevant practical design problems with variant sheet styles.
B5. Proposing Laboratorial Experiments: can assist in preparing laboratory experiment sheets, safety protocols and tips, provide pre-lab instructions, and step-by-step guidance during experiments.
B6. Demonstrating Real-World Case Studies: can find related application case studies and best practices, and help to deliver deeper information analysis into, critical thinking, and discussions.
B7. Depicting Ethical Situations: can generate ethical scenarios and dilemmas, facilitate discussion, analyze perspectives, and suggest solutions.
B8. Advising Creative Teaching Activities: can help in brainstorm creative teaching activities by providing ideas, suggestions, and examples based on the specific needs and goals.
Guide prompt examples:
Here are some prompt examples of how the suggested sub-frame **B** is typically used in the **During-Lecturing (Teaching)** stage (for the **Marine Electrification** course):

B1. "Give me lecture notes with simple illustrations regarding marine propulsion systems"

B2. "Suggest 5 slides layout with content and illustrations to present autonomous shipping systems"

B3. "Can you help me with tools and techniques to develop animation and videos regarding ocean energy resources"

b4. "Provide 5 questions problem solving sheet with solutions regarding design calculations of vessels battery charging"

B5. "Propose three laboratory experiments sheet regarding variable speed drives for ship propulsion"

B6. "Demonstrate 3 real-world case studies of integration of renewable energy into marine power systems"

B7. "Depict different ethical situations regarding new trends in marine electrification"

B8. "Can you advise with 4 different creative activities I can do during my lecturing of marine electrification course"

C. After – Lecturing (Assessment) Stage

The third stage of the proposed framework is the "after lecturing" stage, where the educators need to provide various assessments for the students. Chatbots then can be effectively utilized to give assistance to the teachers in preparing the followings activities:

C1. Making Written Exams: can generate a variety of exam questions, tailored to specific learning objectives and difficulty levels in different styles (multiple choice, true/false, short answer, etc.)

C2. Giving Oral Questions: can provide educators with a bank of potential oral questions to ask students, covering different simulated situations and topics, ensuring a fair and comprehensive assessment.

C3. Recommending Technical Reports: can suggest topics for technical reports, provide guidance on structure and content, and even offer sample of best practice reports.

C4. Initiating Presentation Tasks: can help educators brainstorm presentation topics, provide guidelines for structure and delivery, and suggest potential related resources.

C5. Offering Scientific Poster Ideas: can generate ideas for scientific poster topics, provide guidance on design and content, and even suggest sample posters.

C6. Generating Project Activities: can help educators develop engaging project activities that align with learning objectives to promote independent student assessment with practical project competitions.

C7. Formulating Design Problems: can assist educators in creating challenging simple and complex design problems with suggested software to validate best practice situations and stimulate critical thinking skills.

C8. Originating Personalized Assignments: can help educators create customized assignments that cater to individual students' needs and learning styles to cope with various personalized skills.

Guide prompt examples

Typical guide chatbot prompt examples for effective use of the proposed teaching sub-frame **C** in **After-Lecturing (Assessment)** stage **for the Marine Electrification course;** are as follows:

C1. "Making a written exam of 5 different multiple-choice questions and other 5 fill-in-the-spaces questions, with guide answers, regarding power electronics converters of electric vessels"

C2. "Give me 5 different short oral questions for students to illustrate challenges associated with marine electrification "

C3. "Recommend 3 different scenarios as technical reports for students to discuss recent trends for smart shore power systems"

C4. "Initiate 4 presentation tasks for students to show recent technologies of energy storage systems in ports"

C5. "Make brain storming to offer me 5 different ideas of scientific posters as assessment for students enrolled in the marine electrification course"

C6. "Generate 3 different group project activities for the implementation of PLC based automated system within a ship to help in examine student technical skills"

C7. "Formulate 4 different simple design problems with suggested equations and software to validate best practice in the field of electric vessels power-train"

C8. " I have 3 students in the marine electrification class, with average grade A and other 3 with grade D, can you help me to provide different personalized assignments for these students' categories?"

D. Keep – Connected (Online Class Room) Stage

Based on many practices during different courses, the author has highlighted the importance and positive effects of keeping connected with students as a tool for active learning styles. Hence, this final stage of the proposed framework should be considered. This can be achieved through many available platforms, such as Google Classroom, while the following activities can be on-line fulfilled;

D1. Dispatching announcements: Send announcements and create discussion forums.

D2. Delivering Materials: Store, organize, and share course materials easily.

D3. Collecting assignments: Send and receive assignments and tasks with grading feedback

D4. Launching quizzes: Create quizzes, provide instant result feedback, and analyze.

D5. Documenting feedback: Get online feedback, comments, course evaluation, and documentation.

Google classroom, as depicted in figure 5, is recommended as a guide example for such stage activities,

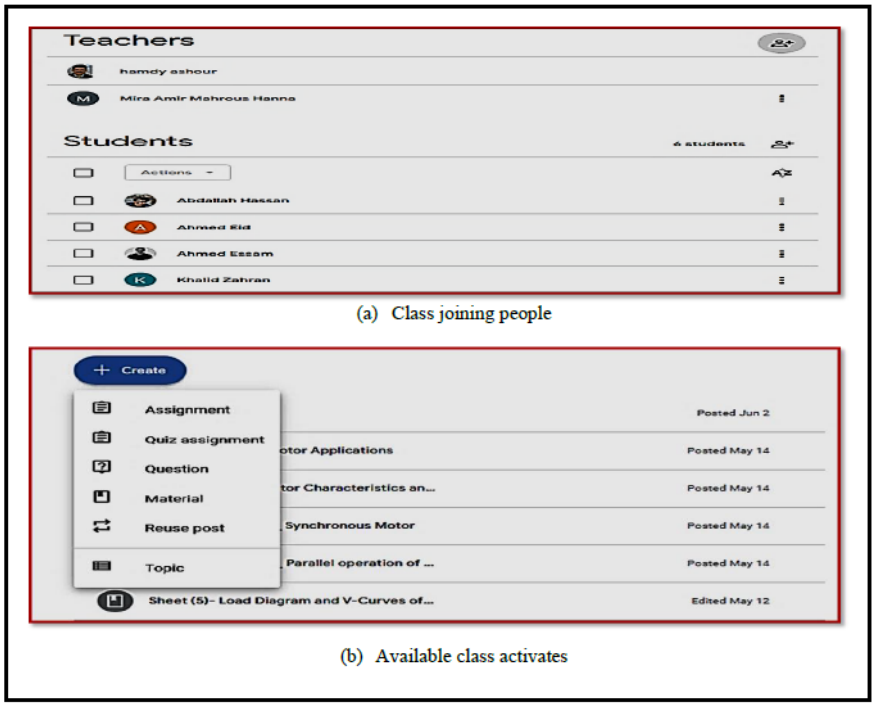

Figure 5: Google classroom as a platform example for online keep-connected stage activities

6. PRACTICE GUIDELINES FOR AI USE IN EDUCATION

As a step ahead to overcome possible challenges and concerns regarding employing generative AI in academic teaching activities, and based on author self-practices and experiences, the author suggested 9S-guidelines for educators to effectively leverage the proposed framework, as listed in Table 1.

Table 1. The 9S-guidelines suggested for educators leveraging generative AI

1S	Set Clear Goals:	Define specific objectives to achieve with the AI's assistance
2S	Select Appropriate Tools:	Choose AI chatbots and tools align with goals and needs
3S	Start Gradually:	Add AI slowly into teaching practices to avoid overwhelming
4S	Support Student Autonomy:	Encourage learners to use AI to explore new knowledge
5S	Supervise and Monitor:	Evaluate to improve and focus to prevent plagiarism and cheating
6S	Share Best Practices:	Collaborate with other educators for more experiences
7S	Sustainably Informed:	Update knowledge with related AI advancements and developments
8S	Seek Help:	Ask experts, professionals or trainers for guidance and support
9S	Stay Human:	Remember, AI is a tool and not a replacement for human interactions

7. CONCLUSION

This research paper has presented a contributed four-stages framework for integrating generative AI chatbots into academic teaching practices. The proposed workflow outlines specific steps, with corresponding guide prompt examples, for educators to implement this assistant technology effectively; ensuring that it aligns with pedagogical goals and academic teaching practices. A set of guidelines for better leveraging of such proposal has been also suggested. While the "Marine Electrification" course has been considered as a guided example, the proposed workflow is generic and can be simply adopted and applied to other courses. The proposal could be a valuable systematic guide for encouraging and fostering educators' engagement in such vital and available assistance tool. Further research is intended and needed, such as dissemination along more staff with evaluative questionnaire, to fully explore the potential benefits and challenges of this approach from the teacher point of view. Also, the effect of applying such framework on students' final performance could be evaluated.

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