JOURNAL OF EDUCATION FOR SUSTAINABLE INNOVATION | ISSN 3025-1052
Vol. 1, No. 1, 2023, 49-60
https://doi.org/10.56916/jesi.v1i1.519

Measures to develop chemistry self-learning capacity for Secondary school students with the support of AI Chatbot

Nguyen Minh Giam*
School of Engineering Education, Hanoi University of Science and Technology, Vietnam

Nguyen Van Doc
School of Engineering Education, Hanoi University of Science and Technology, Vietnam

Nguyen Thi Hoai Nam
School of Engineering Education, Hanoi University of Science and Technology, Vietnam

Nguyen Thi Huong Giang
School of Engineering Education, Hanoi University of Science and Technology, Vietnam

Ngo Tu Thanh
School of Engineering Education, Hanoi University of Science and Technology, Vietnam

***Corresponding Author:** giamhoc@gmail.com

Keywords
AI Chatbot
Self-study capacity
Chemistry
Secondary school students

Article History
Received 2023-09-07
Accepted 2023-10-19

Abstract
AI Chatbot is applied in most areas of life, in the field of education, AI Chatbot is also a term that many educators and teachers are interested in researching and applying. The most common application of AI Chatbot in education is in teaching, AI Chatbot helps teachers make teaching work easier, saving more time. Besides, the development of self-study capacity is also a matter of concern to equip the necessary qualities and skills for an independent learner with a spirit of lifelong learning. The article presents measures to develop the ability to self-study Chemistry with the support of AI Chatbot for junior Secondary school students. Thereby, teachers have orientations for building teaching scenarios to help students self-study and be autonomous when learning with AI Chatbot. With the benefits that AI Chatbot brings, learning with the support of AI Chatbot needs to be used not only in a specific subject or grade level but should be used widely at all levels and for students in different subjects.

INTRODUCTION

Artificial Intelligence is a field in the field of computer science, which is intelligence created by humans with the hope that computers can perform intelligent behaviors like humans, thereby supporting humans in performing tasks (Hwang et al., 2020). Get the job done easier, faster, and more convenient. AI has more and more applications in education, from administrative work, and management, to teaching (Alam, 2021).

Artificial Intelligence in Education is an interdisciplinary community spanning the fields of computer science, education, and psychology (Doroudi, 2022). AI can help each individual by providing

learners with a specialized curriculum based on their needs and skills assessment (Kengam, 2020). AI Chatbot creates a friendly, diverse, and convenient learning environment for learners, helping learners to study anytime, anywhere. With the support of AI chatbots, students can self-study, thereby gradually forming autonomous learners with a spirit of lifelong learning. The article introduces the concept of self-study, teaching, and developing self-study capacity in chemistry. In particular, the article introduces the components of self-study capacity with the support of AI Chatbot and from there proposes measures. Teaching with the support of AI Chatbot helps teachers build teaching scenarios to help students self-study Chemistry.

RESULTS AND DISCUSSION

Proposing a competency framework for self-studying chemistry with the support of AI Chatbot

Process of building a self-study capacity framework for chemistry with the support of AI Chatbot

The framework of students' cognitive abilities in teaching Secondary School Chemistry with the support of AI Chatbot was built by the author according to a 5-step process:

Step 1: Research documents related to renewable energy development with the support of AI Chatbot. Giam and colleagues (2023), An AI Chatbot can be used as a "Virtual Teacher", "Smart Tutor" or "Teaching Assistant" to support students learning Chemistry. This AI chatbot can be designed with scenarios including conversation sequences in text, audio, or image form, supporting teachers to promptly respond to many students at the same time on daily tasks such as lesson plans, Chemical formula, chemical reaction equation. AI Chatbot will divide lessons according to different scenarios, class schedules, exam schedules... for learners. In addition, AI Chatbot can help teachers monitor students' learning and self-study progress. In particular, Chatbot can give comments and feedback to each student, thereby helping teachers evaluate each student toward personalized learning. According to Aoyon et al. (2022), Chatbots provide information, answer questions, guide learning, and encourage students to think and solve problems to help students learn independently. According to Chen et al. (2022), Chatbots can be used to provide information about learning topics, answer students' questions about learning issues,... such as guiding students to solve a problem. math. Peng et al. (2022) said that: Chatbots support self-learning through providing information and guidance on solving problems. Specifically, Chatbot can provide students with information about mathematical concepts, rules for solving problems, etc. This helps students better understand the knowledge needed to solve problems. Chatbots can also guide students to solve math problems step by step.

Step 2: Identify the basis for building a self-study capacity framework. To build a cognitive energy framework for students, the author relies on the following bases:

Chemistry is a subject in Natural Sciences and we rely on the research of Giam et al. (2023) on the structure of the self-study capacity framework for Natural Sciences to build a self-study capacity framework for chemistry with the help of AI Chatbot support. The teaching model uses AI Chatbot as a virtual teacher to support the self-study process for students 24/7. With the characteristics of this teaching model, students can use AI Chatbot before class, during class, and after class.

Step 3: Develop a draft renewable energy framework. The author proposes a framework of cognitive competencies of secondary school students in teaching Chemistry with the support of AI Chatbot including 5 component competencies: (1) Competencies for determining learning goals and tasks; (2) Capacity to ask and look up theoretical knowledge; (3) Skills for explaining experiments and applying them; (4) Capacity to solve exercises on its own; (5) Capacity to self-examine, evaluate and improve learning. After proposing the component competencies, the Author proceeds to describe the

criteria of each competency. The draft competency framework is built with 05 component competencies and 10 criteria with 4 levels of expression below:

Level 1. Renewable energy is weak. This level reflects that students who do not meet the criteria do not show signs of mental illness.

Level 2. Energy is at an average level. This level reflects that students achieve a few criteria, students show signs of mental capacity but not often.

Level 3. Renewable energy is at a good level. This level reflects that students have achieved several criteria, and students have expressed self-reflection skills quite often and positively.

Level 4. Renewable energy is at a good level. This level reflects that students achieve most of the criteria, and students show regular and positive self-esteem.

Step 4: Consult, discuss, and get opinions from experts. After completing the draft competency framework, the author sent it to experts with experience in teaching Chemistry, experts in theory and teaching methods to ask for comments on feasibility and scientificity, suitability for secondary school students.

Step 5: Edit, supplement, and complete the self-learning capacity framework. After receiving comments from experts, the Author proceeded to edit, supplement, and complete the Chemistry subject's Competency self-learning capacity Framework with the support of AI Chatbot including 05 component Competencies and 10 criteria shown in Table 1.

Structure of chemistry self-learning capacity framework using AI Chatbot

Table 1. *Competency framework for Chemistry self-study of Secondary school students in teaching Chemistry with the support of AI Chatbot*

Criteria	**Level**			
	1	**2**	**3**	**4**
Capacity to identify goals & learning tasks				
1. Identify knowledge/skills, and problems in learning and practice.	Students can log in to the "learning box" but have not yet identified the knowledge/skills and problems in learning/practical chemistry that need to be achieved during the self-study process.	Students can log into the "learning box" and identify the knowledge/skills in learning/practical chemistry that need to be achieved during the self-study process but are not detailed or complete.	Students can log into the "learning box" and identify the knowledge/skills in learning/practical chemistry that need to be achieved in the self-study process in a detailed and complete way but are not yet able to predict, evaluate the results achieved in the self-study process.	Students can log into the "learning box" and identify the knowledge/skills in studying/practical chemistry that need to be achieved in the self-study process in a detailed, complete way and are able to predict, evaluate the results achieved in the Self-Study process
2. Identify learning tasks and set up timetables to execute them.	In the "learning box", students have not been able to identify or have not been able to specifically identify or detail the chemistry learning tasks.	In the "learning box", students have been able to identify chemistry learning tasks in a specific and detailed way but have not been able to set up a suitable timetable in the self-study process.	In the "learning box", students have been able to identify chemistry learning tasks in a specific and detailed way and a suitable timetable can be set up regularly or adjusted accordingly in the self-study process.	In the "learning box", students have been able to identify chemistry learning tasks in a specific and detailed way and a suitable timetable can be set up regularly or adjusted accordingly in the self-study process. Thereby,

				students can correct errors and learn lessons for the next self-Study task.
Capacity to ask questions and look up theoretical knowledge				
3. Capacity to learn and ask about theoretical knowledge with virtual teachers	In the "learning box", students have not yet identified the “keywords'', "steps'', and "icons'' related to the content of chemical theory to learn and ask questions with the virtual teacher. Also, students have not yet identified the goals, the content that needs to be studied and the level that needs to be achieved.	In the "learning box", students have been able to identified the “keywords'', "steps'', and "icons'' related to the content of chemical theory to learn and ask questions with the virtual teacher. Also, students can identify the goals, the content that needs to be studied and the level that needs to be achieved, but have not yet identified the methods, allocated time effectively for the self-study process.	In the "learning box", students have been able to identify the “keywords'', "steps'', and "icons'' related to the content of chemical theory to learn and ask questions with the virtual teacher. Also, students can identify the goals, the content that needs to be studied and the level that needs to be achieved for the self-study process. Furthermore, students can identify the methods and allocate time effectively for the self-study process, but still unable to predict, evaluate the results achieved from the self-study process.	In the "learning box", students have been able to identify the “keywords'', "steps'', and "icons'' related to the content of chemical theory to learn and ask questions with the virtual teacher. Also, students can identify the goals, the content that needs to be studied and the level that needs to be achieved for the self-study process. Furthermore, students can identify the methods and allocate time effectively for the self-study process, and are able to predict, evaluate the results achieved from the self-study process. Thereby, students can correct errors and learn lessons for the next self-Study task.
4. Look up theoretical knowledge (about valence, molar mass, elements, elements, reaction equations...)	In the "learning box", students have identified the “keywords'', "steps'', and "icons'' to Look up knowledge related to the content of chemical theory to learn and ask questions with the virtual teacher. Also, students have not yet identified the goals, the content that needs	In the "learning box", students have identified the “keywords'', "steps'', and "icons'' to Look up knowledge related to the content of chemical theory to learn and ask questions with the virtual teacher. Also, students have not yet identified the goals, the content that needs to be studied and the level that needs to be achieved	In the "learning box", students have identified the “keywords'', "steps'', and "icons'' to Look up knowledge related to the content of chemical theory to learn and ask questions with the virtual teacher. Also, students have identified the goals, the content, the methods, the level that needs to be achievedand allocate time effectively for the self-study process, but still unable to predict, evaluate the	In the "learning box", students have identified the “keywords'', "steps'', and "icons'' to Look up knowledge related to the content of chemical theory to learn and ask questions with the virtual teacher. Also, students have identified the goals, the content, the methods, the level that needs to be achievedand allocate time effectively for the self-study process, able to predict, evaluate the

	to be studied and the level that needs to be achieved.	but they have not yet determined the method and have not allocated a proper time schedule for the self-study process.	results achieved from the self-study process.	results achieved from the self-study process, Thereby, students can correct errors and learn lessons for the next self-Study task.
Capacity to explain experiments and apply them				
5. Capacity to explain experiments (through experimental videos, virtual experiments,...)	In the "learning box", Students can enter the keyword "experiment" to ask the virtual teacher to show videos and virtual experiments but Students have not yet understood and explained the theoretical knowledge and phenomena in chemical experiments. Also, students have not yet identified the goals, the content that needs to be Self-Study and the level that needs to be achieved.	In the "learning box", Students can enter the keyword "experiment" to ask the virtual teacher to show the videos and virtual experiments, Students have understood and explained theoretical knowledge and phenomena in chemical experiments. Students have not yet identified the goals, the content that needs to be Self-Study and the level that needs to be achieved, but the method has not been determined and time has not been allocated appropriately for the Self-Study process.	In the "learning box" "students can enter the keyword "experiment" to ask the virtual teacher to show the videos and virtual experiments, have explained theoretical knowledge, phenomena in chemical experiments, have identified the goals, the content that needs to be Self-Study and the level that needs to be achieved, the method has been determined and time has been allocated appropriately for the Self-Study process, but are not yet able to predict, evaluate the results achieved in the self-study process.	In the "learning box", Students can enter the keyword "experiment" to ask the virtual teacher to show the videos and virtual experiments, have explained theoretical knowledge, phenomena in chemical experiments, have identified the goals, the content that needs to be Self-Study and the level that needs to be achieved, the method has been determined and time has been allocated appropriately for the Self-Study process and able to predict, evaluate the results achieved in the self-study process, thereby, students can correct errors and learn lessons for the next self-Study task.
6. Capacity to apply experiments	Through videos and virtual chemistry experiments provided by virtual teachers, students do not understand the chemistry issues in the experiment to apply in real life.	Through videos and virtual chemistry experiments provided by virtual teachers, students understand chemistry, physics, biology and earth science issues in experiments to apply in real life but have not accurate and not consistent with Self-study content.	Through videos and virtual chemistry experiments provided by virtual teachers, students understand chemical, physical, biological, and earth science concepts in experiments for precise and relevant practical application in real life, in line with the self-study content. However, they have not been able to apply this knowledge to solve academic situations or tasks.	Through videos and virtual chemistry experiments provided by virtual teachers, students understand chemical, physical, biological, and earth science concepts in experiments for precise and relevant practical application in real life, in line with the self-study content. Students can also apply knowledge to solve learning situations/tasks clearly and completely, consistent with the Self-

				Study process.
Capacity to independently solve exercises based on the topic.				
7. Instructions and self-solving exercises based on the topic	The virtual teacher is requested to introduce various types of exercises and provide guidance on how to solve sample exercises, but the objectives, self-study content, and the level to be achieved during the self-learning process have not been determined yet.	Requesting the virtual teacher to introduce various types of exercises and provide guidance on how to solve sample exercises. Students have already identified the objectives, self-study content, and the level to be achieved for the self-learning process but have not determined the method and have not allocated appropriate time for the self-learning process.	Requesting the virtual teacher to introduce various types of exercises and provide guidance on how to solve sample exercises. Students have already identified the objectives, self-study content, and the level to be achieved for the self-learning process. They have also determined the method and allocated appropriate time for the self-learning process, but they have not yet anticipated or assessed the results achieved in the self-learning process.	Requesting the virtual teacher to introduce various types of exercises and provide guidance on how to solve sample exercises. Students have already identified the objectives, self-study content, and the level to be achieved for the self-learning process. They have also determined the method and allocated appropriate time for the self-learning process, evaluated the results achieved in the self-learning process, and used that evaluation to make adjustments and draw valuable lessons for the next self-study task.
8. Applying problem-solving by topic.	Through the exercises provided by the virtual teacher, students have not been able to apply them to solve exercises according to various topics.	Through the sample exercises provided by the virtual teacher, students have learned how to apply them to solve exercises based on various topics, but not with complete accuracy and alignment with the self-study content.	Through the exercises provided by the virtual teacher, students have learned how to accurately and appropriately apply them to solve exercises based on various topics in line with the self-study content, but they have not yet allocated an appropriate time frame for the self-learning process.	Through the exercises provided by the virtual teacher, students have been able to accurately and appropriately apply them to solve exercises based on various topics in line with the self-study content. They have learned to allocate an appropriate time frame for the self-learning process and have developed an understanding of new methods for problem-solving.
Capacity to self-examine, evaluate and improve learning				
9. Self-examine and evaluation of learning abilities (objective	Requesting the virtual teacher to provide multiple-choice exercises for students to solve independently, but	Requesting the virtual teacher to provide multiple-choice exercises for students to solve independently.	Requesting the virtual teacher to provide multiple-choice exercises for students to solve independently. Students have already identified	Requesting the virtual teacher to provide multiple-choice exercises for students to solve independently. Students have already

quizzes by topic)	without specifying the objectives, self-study content, and the level to be achieved.	Students have already identified the objectives, self-study content, and the level to be achieved for the self-learning process, but have not yet determined the method and have not allocated an appropriate time frame for the self-learning process.	the objectives, self-study content, the level to be achieved, and the methods required for the self-learning process. They have also allocated an appropriate time frame for the self-learning process, but have not yet anticipated or evaluated the results achieved in the self-learning process.	identified the objectives, self-study content, the level to be achieved, and the methods required for the self-learning process. They have also allocated an appropriate time frame for the self-learning process and have evaluated the results achieved in the self-learning process. As a result, they can make adjustments to address any shortcomings and draw valuable lessons for the next self-learning task.
10. Improving the learning process	Through the learning history in the "learning box," students have not yet found a way to rectify mistakes, limitations, and adapt their learning approaches to new situations in order to enhance their learning during the self-study process.	Through the learning history in the "learning box", they have searched for a method, but haven't found one that truly suits them to rectify mistakes, limitations, and adjust their learning approaches to new situations in order to enhance their learning during the self-study process.	Through the learning history in the "learning box," they have sought suitable methods to effectively rectify mistakes, limitations, and efficiently adjust their learning approaches to new situations. However, they haven't yet known how to analyze and synthesize to develop their own self-learning skills and methods to improve their learning during the self-study process.	Through the learning history in the "learning box," they have found suitable methods to effectively rectify mistakes, limitations, and efficiently adjust their learning approaches to new situations. They have also learned how to analyze and synthesize to develop their own self-learning skills and methods to improve their learning during the self-study process. Moreover, they can support their peers in self-learning and enhance the learning experience for their fellow students.

Measures to develop Chemistry capacity in teaching Chemistry to secondary school students with the support of AI Chatbot

For the capacity component, determine learning goals and tasks

The learning goal and task identification competency component involves a person's ability to set specific learning goals and identify the tasks that need to be performed to achieve those goals. This is an important part of the learning and personal development process.

1. Measure goals

The ability to identify learning goals requires the ability to know clearly what students want to gain from the learning process. This can be a short-term goal (like completing an assignment in a week) or a long-term goal (like achieving a specific qualification or skill).

2. Content

The content of the measure includes 3 steps:

Step 1. Determine the knowledge/skills that need to be achieved

Students determine what knowledge and skills they need to learn in a lesson or a learning content. This may include what the student wants to achieve in their studies, such as a deep understanding of basic concepts, proficiency in solving problems or applying chemistry to real-world problems.

Step 2. Identify problems in learning/practice

Students identify difficulties, challenges, or limitations encountered during the learning process. These problems can appear in many different aspects of the learning process, including knowledge, effective learning methods, interest in learning, psychology, attitude, teacher support, and environment. The school learns to recognize these difficulties and find ways to solve them positively.

Step 3. Identify learning tasks and create an implementation timetable

The bot will list specific, detailed tasks for students to complete and students can create a suitable timetable or regularly adjust accordingly during the self-study process.

3. Implementation conditions

To achieve goals, students need to be able to plan their learning process, including identifying specific steps to take, determining the time and resources needed, and creating a schedule. reasonable.

In summary, to implement the competency component of determining learning goals and tasks, students need to combine many factors such as self-awareness, planning ability, creativity, patience, and many other abilities. to achieve their learning goals.

Capacity *to ask and look up theoretical knowledge*

1. Measure goals

Help students know how to ask the Bot about theoretical knowledge related to the lesson content so that when the Bot answers, students will discover keywords-related knowledge units to look up theoretical content to Learn and ask questions with virtual teachers. Through these iterative processes of questioning and searching, new knowledge will be formed for students

2. Content

The content of the measure includes 2 steps:

Step 1. Learn and ask for theoretical knowledge with virtual teachers

In the "learning box", identify "keywords" related to the learning content according to the outlined learning tasks by entering the keyword "Get acquainted" so that the Bot will provide students with a map. Keywords are the units of knowledge content that have been broken down according to Microlearning. Students learn according to the Bot's suggestions, which are the learning steps. According to these steps, students can ask about related theoretical knowledge. For example, in the knowledge step: Metal reacts with an Acid solution, students learn this chemical property. During the learning process and based on the learning content they are learning, students discover keywords - the Related knowledge units to ask the Bot such as: What is metal? What is acid? What is the name of Acid, Solution... to find out, research and self-study with the support of AI Chatbot Polytechnic Chemistry.

Step 2. Look up theoretical knowledge

In the "learning box", "keywords", "steps", and "buttons" can be identified to look up knowledge related to the content of chemical theory to learn and ask questions with the virtual teacher. For example, in the knowledge step: Metals react with Acid solutions, students can look up metals by entering into Bot: Na, K, Fe... to know the element name, valence... or they can look up Research related reaction equations by entering Bot: Fe + HCl... to know whether the reaction occurs or not and, if so, what is the product formed.

3. Implementation conditions

Students must identify "keywords" related to the content of knowledge that has been broken down according to Microlearning. Know how to look up knowledge related to chemical theory content to learn and ask questions with virtual teachers.

Capacity to practice experiments and applications

1. Measure goals

Through videos and virtual experiments provided by virtual teachers, through observations of chemical reaction phenomena combined with notes on paper, students can grasp and explain theoretical knowledge and phenomena. learning that students have encountered in real life.

2. Content of measures

The content of the measure includes the following steps:

Step 1. Practice chemical experiments (through experimental videos, virtual experiments,...)

In the "learning box", enter the keyword "experiment" to ask the virtual teacher to watch videos and virtual experiments. Students focus on following and observing each step in the experimental video, recording reaction phenomena, reaction equations, and products formed... on paper.

Step 2. Apply experiments

Through videos and virtual experiments provided by virtual teachers, through observations of chemical reaction phenomena combined with notes on paper, students can grasp and explain theoretical knowledge and phenomena. learning that students have encountered in real life. Students combine and ask the Bot questions such as chemical phenomena, explanation of phenomena, practical application... to expand knowledge from chemical phenomena and application of chemistry in life.

3. Implementation conditions

Students must know how to ask the Bot questions such as: chemical phenomena, explanation of phenomena, practical applications... to expand knowledge from chemical phenomena, chemical applications in life. Students must focus on following and observing each step in the experimental video, recording the reaction phenomena, reaction equations, and products formed on paper.

Capacity to independently solve exercises based on the topic

1. Measure goals

Students request the Bot to provide basic exercise types by topic so that they can learn how to solve problems on that topic under the guidance of the Bot.

2. Content

The content of the measure includes 2 steps:

Step 1. Instructions and self-solving exercises based on the topic

Students request the Bot to provide basic exercise types by topic. They study with the guidance of the Bot to understand various sample exercise types and solution methods for each type. Students follow and learn step by step how to solve a chemistry problem, enabling them to independently apply these methods to solve other chemistry exercises.

Step 2. Applying problem-solving by topic.

In step 1, students have gained an understanding of the steps to solve various exercises by topic. In this application step, students must have a command of chemical formulas, reaction equations, the sequence of reactions, the molar mass of elements, and more. If students are not yet familiar with specific formulas, they can ask the Bot for formulas such as calculation formulas, mole calculation formulas, the law of conservation of mass, look up the molar mass of chemical elements, or search for chemical equations within the exercises. Students read the problem statement and determine which exercise type within the studied topic it belongs to. They assess whether there is a combination of different exercise types within the topic and how they are interconnected. Subsequently, students visualize the transformation of substances by writing reaction equations and integrating the solution steps for exercise types within the topic to intelligently and accurately solve the problem.

3. Implementation conditions

Students must know how to request the Bot to provide basic exercises by topic. Students must have a command of chemical formulas and know how to inquire with the Bot when they don't understand how to apply and solve exercises by topic.

Capacity to self-examine, evaluate, and improve learning

1. Measure goals

After each time he finishes self-studying a topic, Hoc asks the Bot to provide objective multiple-choice questions for students to answer to self-assess their self-study capacity. Through the process of taking objective tests, students will be given their own skills and self-study methods to improve their learning during the self-study process.

2. Content of measures

The content of the measure includes 2 steps

Step 1. Self-test to assess learning capacity (objective tests according to topics)

Students ask the Bot to provide objective multiple-choice questions according to the topic to solve. When encountering questions that students do not understand, they ask the Bot that idea to supplement their knowledge to solve the multiple choice question. that experience. Learn to self-assess your learning results through the test-taking process by the number of correct and incorrect questions and the number of times you ask the Bot. Students can re-do objective questions and ask the bot many times, over and over to remember knowledge and form problem-solving skills.

Step 2. Improve learning

Through self-testing and assessment, students can retake objective tests combined with their learning history with Bot - steps to solve an objective multiple-choice question to relearn knowledge that they have not yet mastered. , errors... from which to find appropriate measures to effectively overcome errors, and limitations and effectively adjust the learning style to new situations. Thereby, students analyze and synthesize to create their own skills and self-study methods to improve their learning during the self-study process.

3. Implementation conditions

When encountering a difficult question, students must know how to ask the Bot for unclear ideas or unclear content so that the Bot can supplement students' knowledge to solve multiple-choice questions on that topic. In the process of interacting with the Bot to solve objective multiple choice exercises, students must be patient and know how to relearn knowledge they have not yet mastered and errors.

CONCLUSION

This article presents 05 measures to develop self-study capacity in Chemistry for secondary school students with the support of AI Chatbot. These 5 measures correspond to the 5 components of chemistry competency. Although each measure may be different in goals, content, and implementation conditions, all 5 measures rely on the support of AI Chatbot to (1) Promote students' autonomy, creative thinking, and problem-solving capacity; (2) Create an interactive environment to help students explore and develop their self-learning capacity; (3) When having difficulty understanding the lesson, AI Chatbot can step by step suggest, provide answers and similar sample solutions for students to solve the problem themselves.

Based on the content of the 5 measures presented, the next orientation will focus on (1) Researching the impact of using AI Chatbot in developing students' self-learning capacity. This includes measuring improvements in student performance, creative thinking, self-management skills, and changes in learning mindsets; (2) Research how students interact with chatbots and how chatbots can adapt to their learning styles. Further analysis of common question types, requests, and interactions to improve chatbot responsiveness; (3) Research ways to effectively customize and personalize chatbots for each student. Consider methods that automatically generate advice, assignments, and learning content tailored to students' abilities and goals; (4) Compare the performance and impact of using AI Chatbot with other traditional teaching and learning methods. This helps evaluate whether chatbots can improve learning performance. In summary, continued research in using AI Chatbot to develop students' self-learning capacity requires extensive analysis of the impact, performance, and optimization of Chatbot's capabilities.

REFERENCES

Alam, A. (2021, December). Should robots replace teachers? Mobilisation of AI and learning analytics in education. In *2021 International Conference on Advances in Computing, Communication, and Control (ICAC3)* (pp. 1-12). IEEE.

Aoyon, R. S., Ara, Y., Baptee, T. A., Hossain, M. S., Afroz, M., Mehedi, H. K., & Rasel, A. A. (2022). A Self-Learning French Language Learner Assistant Chatbot Leveraging Deep Learning. *In 2022 13th International Conference on Information and Communication Technology Convergence (ICTC) (pp. 598-602)*. IEEE. https://doi.org/10.1109/ICTC55196.2022.9953013

Chen, Q., Gong, Y., Lu, Y., & Tang, J. (2022). Classifying and measuring the service quality of AI chatbot in frontline service. *Journal of Business Research*, 145, 552-568. https://doi.org/10.1016/j.jbusres.2022.02.088

Doroudi, S. (2022). The intertwined histories of artificial intelligence and education. *International Journal of Artificial Intelligence in Education*, 1-44.

Giam, N. M., Nam, N. T. H., & Giang, N. T. H. (2022). Situation and Proposals for Implementing Artificial Intelligence-based Instructional Technology in Vietnamese Secondary Schools. *International Journal of Emerging Technologies in Learning*, *17*(18). https://doi.org/10.3991/ijet.v17i18.31503

Hwang, G. J., Xie, H., Wah, B. W., & Gašević, D. (2020). Vision, challenges, roles and research issues of Artificial Intelligence in Education. *Computers and Education: Artificial Intelligence*, *1*, 100001.

Kengam, J. (2020). Artificial intelligence in education. Research Gate. *Science and Technology Department Bournemouth University Bournemouth*, United Kingdom.

Nguyen Minh Giam, Nguyen Thi Hoai Nam, Nguyen Thi Huong Giang (2023), Building a self-study competency framework for junior high school students in teaching branch of natural sciences

with the support of AI chatbot, *Vietnam Journal of Education*, Special issue 9 (September), ISSN: 2354-0753

Peng, C. G., Lee, S. Y., & Sun, K. T. (2022). Artificial Intelligence and Cognitive Science Case Grammar on Solving Chinese Arithmetic Word Problems in Elementary Schools. In 2022 IEEE 5th *Eurasian Conference on Educational Innovation (ECEI) (pp. 114-117)*. IEEE. https://doi.org/10.1109/ECEI53102.2022.9829492

Wailthare, S. (2018). Artificial intelligence based chatbot. *Artificial Intelligence*, 5(03), 2305-2306.