International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 12 December 2023
DOI: 10.47191/ijcsrr/V6-i12-59, Impact Factor: 6.789
IJCSRR @ 2023

Design of Knowledge Flow According to the Approach of Self-Regulation Learning for Teaching Maths on Chatbot

Nguyen Thi Hoai Nam[1], Nguyen Thi Huong Giang[2]
[1] PhD Candidate, Faculty of Education, HaNoi University of Science and Technology, Vietnam
[2] PhD in Education Science, Faculty of Education, HaNoi University of Science and Technology, Vietnam

ABSTRACT: Each student has different skills, interests, and learning paces in a classroom. If each student has a personal tutor to support learning according to their ability, it will improve the quality of teaching and no student will be left behind. In reality, no school has enough teachers to support individual learning, but each teacher has to handle many students in the same class. Therefore, an AI Chatbot that acts as a "virtual teacher" next to a real teacher can do that. AI Chatbot can support individual students in a friendly, interesting environment and provide knowledge depending on their cognitive level. Learning with AI Chatbot also helps students feel more interested and motivated with new learning methods. Instead of teachers providing information and knowledge for students to remember and apply, AI Chatbot will help learners build and create their knowledge through interactions and experiences. Besides providing answers to learners' queries, Chatbots can provide step-by-step instructions to achieve teaching goals for specific lessons. In this article, the authors based on the applications of AI Chatbot in teaching to present a teaching scenario using AI Chatbot to teach mathematics with a self-regulated learning orientation for primary school students. Specifically, the authors have built a scenario for the “Millimeter” lesson in the Mathematics, 3rd Grade according to three phases of self-regulated learning: forethought, performance and self-reflection.

KEYWORDS: Educational Chatbot, Self-Regulated Learning, Teaching Mathematics in Primary School, Game Design Elements, Knowledge Flow, Virtual Teacher.

INTRODUCTION

The term Chatbot has been around for a long time, but there is no unified definition for Chatbot. Shawar and Atwell[1] define chatbots as computer programs that interact with users in natural language, the ability to answer questions from simple to engage in complex conversations. Agarwal (2022) [2] states that chatbots are software applications that can recognize input patterns and produce results according to that input. Chatbots or “bot conversational” are artificial intelligence-based programs that allow user-to-machine interaction based on written or spoken code[3]. AIChatbot is an automated software using artificial intelligence (AI) that simulates conversational interaction between a user and a computer, using natural language[4], when chatbot technology is enabled, the user can 'talk' to pre-made AI chat robots, not to individual humans[5].

From the above definitions, it is easy to find that AI Chatbot is a conversational program that creates natural language conversations for users with different uses. Besides reducing the repetitive tasks of humans, AI Chatbot can also perform complex tasks, bringing many benefits to us.

Educational Chatbot is specialized for supporting schools and institutions in teaching, assessment, administration, and research. According to Riel (2020) [6], an educational Chatbot is a support program aimed at achieving educational and pedagogical goals. Bii (2013)[7] defines an educational chatbot as a chatbot conceived for clear learning goals. There have been many applications of AI Chatbot in the field of education, but the most talked about application is AI Chatbot which acts as a teaching and learning aid.

During the teaching process, AI Chatbot supports educators and teachers in teaching; supports and guides students in learning. AI Chatbot provides knowledge, lectures, materials, provides feedback to student questions, and supports students to learn automatically, quickly, accurately, anytime, anywhere.

Chatbots use natural language conversation to increase flexibility and interaction for students. Additionally, when provided with questions, chatbots can provide learners with step-by-step instructions toward the final solution. Therefore, besides providing queries for students' questions, Chatbot can also provide students with specific learning content by topic or specific lesson. Guiding students to learn according to a certain process brings many benefits to learners. Not only that, using Chatbot to teach according to the phases

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IJCSRR @ 2023

of self-regulated learning helps learners gradually form awareness and motivation to learn, actively pursue learning goals, and control the process. their learning, thereby equipping learners to be self-reliant and independent person not only in studying but also in solving problems in life.

To deploy teaching on Chatbot in the direction of supporting self-regulated learning for primary school students, the authors have taken the following steps:

- Search and select typical applications of AI Chatbot in teaching around the world;
- Develop a teaching scenario using AI Chatbot for applying self-regulated learning into primary school students;
- Build an AI Chatbot to teach the "Millimeter" lesson in the Mathematics , 3rd Grade according to the proposed scenario.

1. Applications of AI Chatbot in Teaching

In recent years, AI Chatbot has been increasingly applied in many fields and education is no exception. The first application to mention AI Chatbot in education is Chatbot which supports the teaching and learning process. Some specific applications such as smart tutoring systems, teaching assistants, and learning assistants... help reduce repetitive tasks for teachers and increase interest and participation in learning, improving efficiency. learning outcomes and achievements for students. Akcora et al (2018) [8] introduced a content-based learning assistant that is not a topic. This learning tool not only helps optimize conversation but also establishes a friendly and empathetic relationship with the learner. Besides, this tool can also be used to collect information about students' current situation.

Mikic et al (2008) [9] developed two Bots based on AIML(Artificial Intelligence Markup Language) to support teaching activities. In which a Bot acts as a tutor (T-bot) and communicates with learners in natural language to provide them with complete and specific answers, orienting learners to the course content. study appropriately.

Grossman et al 2019 [10] developed MathBot, a text-based automated tutor to explain mathematical concepts, provide practice questions, and provide students with appropriate feedback. Research shows that students prefer Mathbot over learning through videos or other written instructions. In addition, research also shows that conversational agents promise to be an effective tool to supplement online math learning when it has additional features such as personalized live instruction.

Wijdane Kaiss et al [11] presented a new adaptive learning method according to the learner's learning style, mainly based on the use of a chatbot called Learning PartnerBot to implement the adjustment of learning objects according to the learner's style. learners' learning style. In addition, the authors also use the Felder-Silverman Learning Style Model so that the Chatbot can personalize recommendations about learning objects. The results show that the authors' suggestions have improved learners' learning outcomes; the LearningPartnerBot chatbot is considered interesting, useful and has a positive impact on learners' learning attitudes.

Through the applications of AI Chatbot in teaching, we can see that using AI Chatbot in teaching can help personalize learners according to their abilities, interests and learning styles. Not only that, if teachers use AI Chatbot in teaching flexibly and skillfully, it will also help students learn to self-regulate.

2. SELF-REGULATED LEARNING METHOD

Self-regulation is an essential element of the learning process. It can help students have better motivation and study habits, strengthen study skills, and improve academic achievement. Seeing the importance of self-regulated learning for students, the authors us the self-regulated learning method as a theoretical basis to propose a teaching scenario using AI Chatbot combined with game design elements in teaching maths in primary school.

2.1. Self-regulated learning

Self-regulated learning (SRL) is an important subject of research in the field of education, which was developed in the 1980s and received widespread attention in the 1990s due to profound changes in educational psychology [12].

According to Zimmerman, SRL is the process of learners actively adjusting their cognition, emotions and behavior to improve learning efficiency and achieve learning goals [13]. It is an active learning process that involves students being aware of the strengths and limitations of their learning and being able to carry out learning appropriate to their skills and performance.[14]

Roberts [15] states that self-regulated learning is a process that supports students in managing their thoughts, behaviors, and emotions to successfully navigate their learning experiences. This process occurs when students' purposeful actions and processes are directed toward acquiring information or skills.

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Thus, it can be understood that self-regulated learning is a learning process in which learners can be self-aware of their needs, interests, learning style, learning pace, learning tasks, self-planning tasks, self-assessment of the learning process and results, thereby adjusting learning activities and learning speed accordingly.

Self-regulated learning is a cyclical process in which students plan a task, monitor their performance on that task, and then reflect on the results. efficiency and performance. This cycle then repeats as students use reflection to adjust plans and strategies and prepare (after learning from experience and adjusting) for the next task. This process is not one size fits all; This process should be adjusted for each student and each specific learning task, for each specific subject [16].

Ali Alharbi et al [17] presented the results of research investigating the potential educational effectiveness of a pedagogical framework based on self-regulated learning theory to support the design of online learning object systems. The system was evaluated through a two-semester experimental study in a single course. Research results show that the learning object system is an effective intervention in supporting students to self-regulate their learning activities and can be an effective learning environment.

The study by Jose Carlos Redaelli [18] presented self-regulated learning strategies applied to students to investigate the effects of self-regulated learning strategies applied in class. In addition, the authors also implemented a learning strategies assessment scale to identify cognitive learning strategies, metacognitive learning strategies, and ineffective learning strategies. The authors used classroom interventions to impart several learning strategies to students. The interventions follow the Self-Regulated Learning Model. The results show that this test has the potential to be effective, but there are still some limitations.

Pratya Nuankaew[19] conducted a study on the paradigm shift of the education system focusing on the implementation of artificial intelligence technology to support the learning model during the COVID-19 pandemic situation. The research was carried out with two goals: the first is to research a self-regulated learning model in accordance with data mining techniques to design online learning management, the second is to research the success factors. learners' learning achievements by applying blended learning and self-regulated learning techniques. The results show that self-regulated learning theory is becoming increasingly popular and recognized. However, the need for instructor participation in the phases of self-regulated learning and the online learning process in general is a major obstacle to setting learning goals for learners.

Suartama et al [20] examined the impact of popular learning strategies using self-regulated learning methods on students' academic achievement and interest in learning. The authors conducted experiments on 113 students using measurement tools and objective tests. The results show that there are significant differences in academic achievement and learning initiative between groups of learners using common learning strategies and e-learning strategies; There are significant differences in learning positivity and academic achievement among students when self-regulated learning is integrated at different levels; There is an interaction between integrated e-learning strategies and self-regulated learning on students' learning engagement and academic achievement. Depending on the ability to self-regulate learning, each learner will achieve goals, increase learning initiative and achieve different learning achievements.

Effat Alvi and Robyn M. Gillies (2020) [21] presented an integrative, ecological model of self-regulated learning in a teacher-perspective, belief-based, practice-based context and classroom regulations. Teachers are aware of the key components of self-regulated learning such as cognitive, metacognitive, motivational, behavioral and strategic components, thereby having a positive attitude toward supporting self-regulated learning student corrections. Research notes that teachers can support students' self-regulated learning in a variety of ways, such as by providing structure and examples, modeling self-regulated learning strategies, providing feedback and promoting a positive learning environment. However, teachers also face challenges in promoting self-regulated learning, such as limitations in time, resources and training, curriculum, assessment, family, and community.

Timothy J. Cleary, et al (2017) [22] examined the effectiveness of an applied self-regulated learning intervention (Self-Regulation Empowerment Program - SREP)) compared to Existing school-based math learning remedial interventions aim to improve students' motivation, skills, strategies, and math achievement. The results showed that the SREP group showed a statistically significant and more positive trend in Mathematics academic achievement. In addition, teachers and students considered SREP to be a socially valuable intervention, in terms of acceptability and importance.

Andrew N Porter and Erin E. Peters-Burton [23] examined how science teachers in middle school support the development of students' self-regulated learning. The results of the study showed that teachers mainly used the SRL coaching strategies of observation and simulation, emphasizing different SRL processes. Besides, although most teachers have set goals for their teaching process, they do not evaluate based on those goals but still evaluate their students based on the goals of the product.

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Flavia Aurelia Hidajat [24] conducted an experimental study to determine the influence of self-study on creative mathematics teaching through the e-learning application "zoom". Research results show that implementing self-regulated teaching brings more success to creative math teaching through the mobile e-learning application "Zoom" than conventional strategies because students can Adjusting their perception to think of new ideas, students can come up with many different creative solutions. This study suggests that educators should consider implementing self-regulated learning strategies in each lesson plan to enhance students' creativity.

2.2. Self-regulated learning model

There are many models of self-regulated learning, one of the popular models of self-regulated learning is Zimmerman's 3-phase cycle. This model is a cycle of three phases: forethought, implementation, and self-reflection [25].

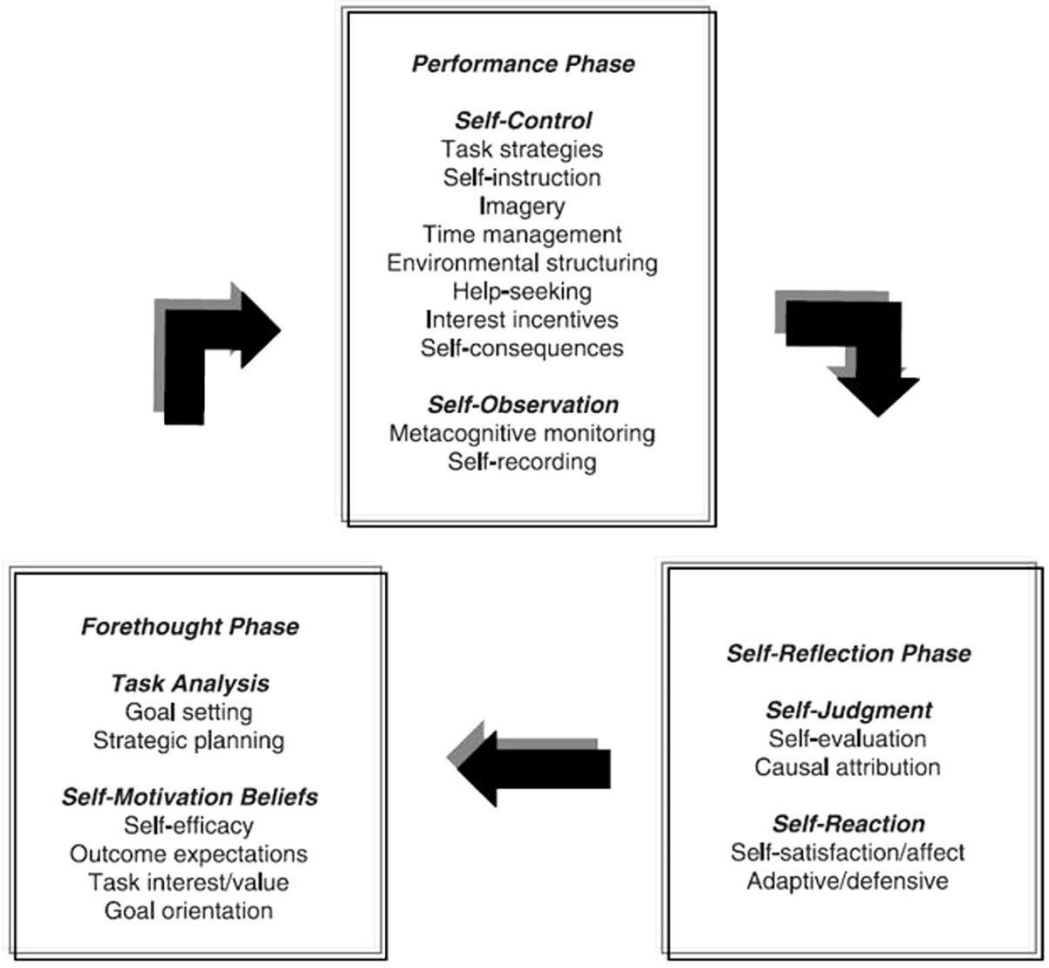

Figure 1. Zimmerman's Cyclical Phases Model).

Adapted from Zimmerman and Moylan (2009) [26].

During the forethought phases, students analyze the task, set goals, plan how to achieve them and some beliefs to drive the process and influence the activation of learning strategies. During the performance phase, the students perform the task, while they monitor their progress and use several self-control strategies to keep themselves cognitively engaged and motivated to complete the mission. Finally, in the self-reflection phase, students evaluate how they performed the task, making attributions about their success or failure. These attributions create self-reactions that can positively or negatively influence how students approach the task in future sessions.

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During the forethought and planning phase, students will think and analyze their own learning tasks and set specific goals to complete those tasks. This phase also includes certain beliefs to accelerate the process and influence the activation of learning strategies, which helps students use their time and effort more effectively. At this phase, students will also make detailed and specific plans to perform tasks to achieve goals that suit their style and current abilities. However, with new topics and learning content, students may not know which approach to a task or goal is most appropriate. Therefore, teachers and educators will guide students on effective approaches.

During the performance phase, students use strategies to make progress in performing study tasks. Students also monitor the effectiveness of those strategies as well as their motivation to continue moving toward the task goals. For different learning tasks, different strategies need to be used to perform and achieve the goal quickly and easily. However, students often do not use new strategies but return to using old, familiar strategies, which leads to significantly ineffective learning. At this phase, teachers need to closely monitor and give specific and timely feedback to students learning how to use new strategies, helping students confidently use and see the effectiveness of using the strategy. new strategies instead of familiar, inappropriate strategies when performing new tasks.

In the final phase, self-reflection, students self-assess their performance, their approach towards carrying out the learning task concerning the effectiveness of the strategies and plans they have chosen. During this phase, students must also manage their emotions about the outcome of the learning experience. These self-reflections then influence the student's future learning plans and goals for the new cycle. At this phase, teachers need to motivate, encourage, and promote students' motivation and confidence in the results they have achieved, and orient students with plans and strategies for the tasks in the cycle. new[27].

2.3. The essence of self-regulated learning process

Self-regulated learning is an active learning process, this process brings students certain benefits and has important meanings for students. This process helps students become aware of their strengths to promote and their weaknesses to limit, thereby striving to gradually become more progressive, becoming autonomous learners and competent learners. can pursue their interests. Achieving this requires the necessary support from teachers and requires students to put in effort and perseverance over time.

Therefore, the essence of this process is that the teacher acts as a guide, orientation, and supporter to help students get acquainted and gradually form habits and abilities to set their own goals. Make your learning plans, carry out your teaching activities and self-evaluate your learning process and learning results. In addition, teachers also have the role of promoting learning motivation, and creating personal confidence for students to help them overcome difficulties and challenges in the process of conquering knowledge. This helps give students more control over their learning, being able to adapt their strategies to meet the needs of different tasks.

In general, Teacher's supports for student in SRL process include: Instructional support (cognitive and metacognitive support), motivational and behavioral support, instrumental support /strategy, promote critical thinking, continuous monitoring and feedback, support entertainment, and involve community. During the teaching process, teachers can use, change, adapt and combine some or all of these categories in different ways to support students per their beliefs, practices and environments which they work [28].

After learning about the essence as well as the three phases of self-regulated learning, the authors applied self-regulated learning theory to design the knowledge flow for the “Millimeter” lesson in the Mathematics , 3rd Grade and load its data to Chatbot for teaching.

3. DESIGN THE KNOWLEDGE FLOW OF THE LESSON AND THE EXCHANGE PROCESS ON CHATBOT

Table 1: The knowledge flow of the lesson and the exchange process on Chatbot

Phases of self-regulated learning	***Teachers design the knowledge flow of the lesson***	***AI Chatbot’s Interface***	***Students’ SRL Process***
Startup	Teachers create problem situations that lead students into the lesson so that		- Enter the text: “Học bài Mi-li-mét”

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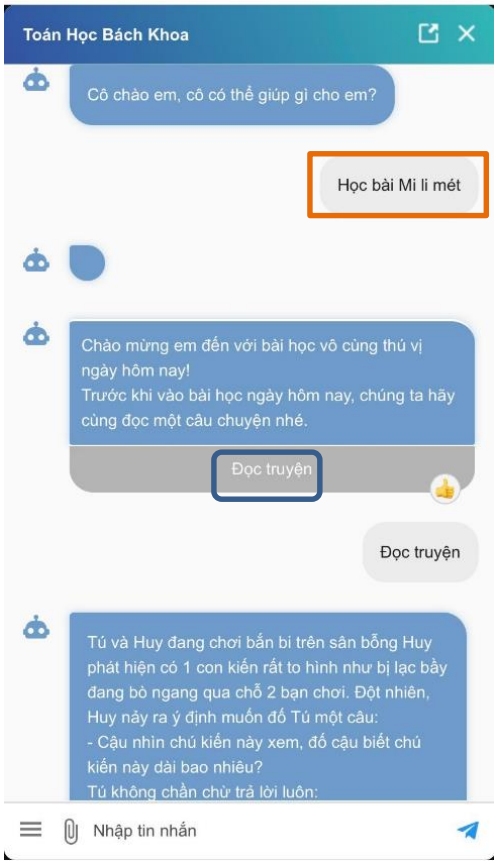
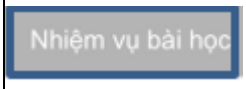
	students are more interested in participating in learning	After the greeting, the Bot begins to guide students through learning step-by-step  After presenting the situation, the Bot will lead students into the lesson to solve the problem	- Click the button  or enter the text "Đọc truyện" to read, this is also the situation that the teacher gives to students. - Students click the button  or enter the text “Vào bài học” to start the first part of the lesson. Students click the button  or students enter the text “Nhiệm vụ bài học” to get the learning tasks.

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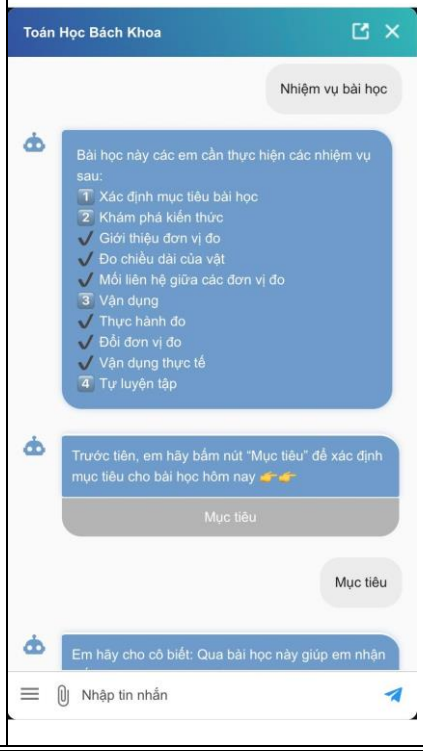
Phase1: *Forethought*	- Teachers support students in analyzing learning tasks - Teachers guide students to set their own lesson goals through questions. If the student does not determine correctly, the teacher will promptly support the student to correctly determine the goals that need to be achieved. - Encourage students to make their own personal learning plans by allowing them to choose the order in which they perform learning tasks according to their	- The bot leads students in analyzing learning tasks 	- Students click the button or enter "Mục tiêu" and answer the questions asked by the bot to determine the goals they need to achieve after the lesson

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	learning style, interests and abilities.	- Bot helps students set their own lesson goals 	- Make a personal learning plan by arranging the order of learning tasks according to their interests and learning style, then enter it into the Bot's dialog box.

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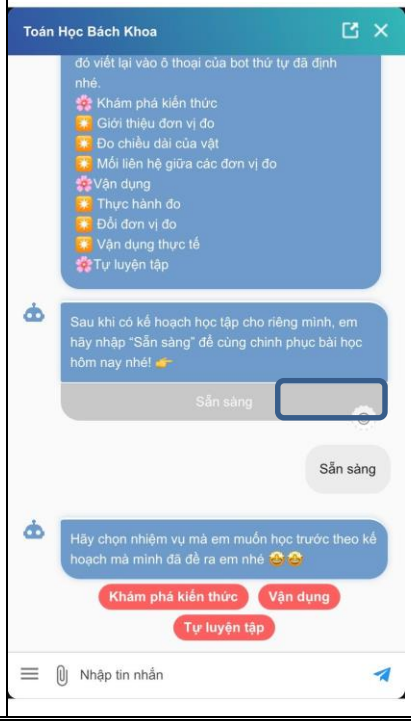
		- Make a learning plan 	
Phase 2: *Performance*	Teachers guide students to learn lesson content through instructions, lead students with close, non-pressured requests and questions, and at the same time, create motivation for them to learn, reminding them to Remind them promptly to practice carefulness. In this part, students study on their own with the guidance and support of the teacher to form knowledge, thereby achieving the lesson objectives. Depending on each student's learning plan, if a student chooses a learning task that he or she has not achieved, lead the student to another necessary task related to the	- When ready, the Bot lets students choose units of knowledge according to their interests, style and abilities 	- Enter the text "Sẵn sàng" or press button:  - Choose the first learning task in the selected order

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	task and then return to the task. selected service	[Explore knowledge]  The bot guides students to explore each content of knowledge according to each student's individual choice  [Apply knowledge] - The bot allows students to choose the type of exercise:	- Watch video lectures sent by Bot. After viewing and understanding the content student learned, click "Back" to move on to another task in the selected menu. - Click on the button to select the type of

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			exercise students want to do first - Answer In this part, if the answer is correct, move on to the next question. If it is incorrect, the bot will suggest content to re-study until the student answers correctly, then the bot will lead through the questions and next steps.
Phase 3: *Self-reflection*	- Teachers let students play games, essentially giving them exercises to regularly evaluate students' learning results. The game is designed to include questions related to the content of the Millimeter card. In this part, students do their own work without any guidance or support from the teacher, thereby reflecting on the results of their learning process. From there, students can see for themselves whether they have achieved the initially set learning goals, whether their learning speed is fast or slow, whether they have improved or not, whether	[Practice on your own] The bot helps students practice on their own by letting them play maths games	- Press the button  to start playing the game - Typing the text "Hoàn thành trò chơi" to finish the game. - Get mark.

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	they have put effort into the learning tasks or not to have orientation for the next learning content. At the same time, teachers can also evaluate each of their students through the Bot and game results sent back to provide guidance for appropriate support next time.	 Bot asks students to restudy if the score achieved through  the game is too low.	- Press the button  to study again until student understand the lesson and can do the exercises more effectively.

The teaching sequence using AI chatbot to support students in self-regulated learning is a scenario that teachers build to help students self-study with AI Chatbot virtual teachers. In 3 phases of self-regulated learning, AI Chatbot support students in managing and regulating their thought, behaviors, and emotion to successfully navigate the learning experience, thereby increasing their motivation and academic achievement [29], as well as help them study anytime, anywhere.

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4. CONCLUSION

Forming and developing self-regulated learning capacity for elementary school students is a proposal that causes doubt among parents and teachers in Vietnam because the learners are still young and their learning skills are lacking abundant. Therefore, learning experiences with Chatbots to learn Mathematics and develop self-regulated learning skills as proposed in the article need to be seriously researched and evaluated in classrooms in Vietnam. This is also the direction of expanding the research of the authors in subsequent publications.

REFERENCES

1. Shawar, B. A., & Atwell, E. 2007. Chatbots: are they really useful?. Journal for Language Technology and Computational Linguistics, 22(1), 29-49.
2. Agarwal, S., Agarwal, B., & Gupta, R. 2022. Chatbots and virtual assistants: a bibliometric analysis. Library Hi Tech, 40(4), 1013-1030.
3. Vázquez-Cano, E., Mengual-Andrés, S., & López-Meneses, E. 2021. Chatbot to improve learning punctuation in Spanish and to enhance open and flexible learning environments. International Journal of Educational Technology in Higher Education, 18(1), 1-20.
4. Maroengsit,W., Piyakulpinyo, T., Phonyiam,K., Pongnumkul,S., Chaovalit,P. and Theeramunkong,T. 2019. A Survey on Evaluation Methods for Chatbots. In Proceedings of the 7th International Conference on Information and Education Technology (ICIET 2019). ACM, New York, NY, USA, 111-119. DOI=10.1145/3323771.3323824
5. Molnár,G. and Szüts, Z. 2018. The Role of Chatbots in Formal Education, IEEE 16th International Symposium on Intelligent Systems and Informatics (SISY), Subotica, 197-202. doi= 10.1109/SISY.2018.8524609
6. Riel, J. 2020. Essential features and critical issues with educational chatbots: toward personalized learning via digital agents. In: M. Khosrow-Pour (Ed.), Handbook of research on modern educational technologies, applications, and management (pp. 246–262). IGI Global. 10.1142/S0218194019400163.
7. Bii P. Chatbot technology: A possible means of unlocking student potential to learn how to learn. Educational Research. 2013;4(2):218–221.
8. Akcora, D. E., Belli, A., Berardi, M., Casola, S., Di Blas, N., Falletta, S., ... & Vannella, F. 2018. Conversational support for education. In Artificial Intelligence in Education: 19th International Conference, AIED 2018, London, UK, June 27–30, 2018, Proceedings, Part II 19 (pp. 14-19). Springer International Publishing.
9. Mikic, F. A., Burguillo, J. C., Rodríguez, D. A., Rodríguez, E., & Llamas, M. 2008. T-Bot and Q-Bot: A couple of AIML-based bots for tutoring courses and evaluating students. In 2008 38th Annual Frontiers in Education Conference (pp. S3A-7). IEEE.
10. Grossman, J., Lin, Z., Sheng, H., Wei, J. T. Z., Williams, J. J., & Goel, S. 2019. MathBot: Transforming online resources for learning math into conversational interactions. AAAI 2019 Story-Enabled Intelligence.
11. Kaiss, W., Mansouri, K., & Poirier, F. 2023. Effectiveness of an Adaptive Learning Chatbot on Students' Learning Outcomes Based on Learning Styles. International Journal of Emerging Technologies in Learning, 18(13).
12. Bembenutty, H. 2011 Self-Regulated Learning: New Directions for Teaching and Learning. John Wiley & Sons, Hoboken.
13. Zimmerman, B. J., & Martinez-Pons, M. 1990. Student differences in self-regulated learning: Relating grade, sex, and giftedness to self-efficacy and strategy use. Journal of educational Psychology, 82(1), 51.
14. Zimmerman, B. J. 2002. Becoming a self-regulated learner: An overview. Theory into practice, 41(2), 64-70.
15. Roberts, E. D., Tadlock, J., & Zumbrunn, S. 2011. Encouraging self-regulated learning in the classroom: A review of the literature. Metropolitan Educational Research Consortium.
16. Zimmerman, B. J. 2002. Becoming a self-regulated learner: An overview. Theory into practice, 41(2), 64-70.
17. Alharbi, A., Henskens, F., & Hannaford, M. 2014. Personalised Learning Object System Based on Self-Regulated Learning Theories. Int. J. Eng. Pedagog., 4(3), 24-35.
18. Redaelli, J. C., & Lima Jr, O. F. 2013. Self-regulated learning strategies applied to undergraduate, graduate and specialization students from civil engineering. International Journal of Engineering Pedagogy (IJEP), 3(S2), 23-26.

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ISSN: 2581-8341
Volume 06 Issue 12 December 2023
DOI: 10.47191/ijcsrr/V6-i12-59, Impact Factor: 6.789
IJCSRR @ 2023

19. Nuankaew, P. 2022. Self-regulated learning model in educational data mining. International Journal of Emerging Technologies in Learning (Online), 17(17), 4.
20. Suartama, I., Setyosari, P., Sulthoni, S., Ulfa, S., Yunus, M., & Sugiani, K. 2021. Ubiquitous learning vs. electronic learning: a comparative study on learning activeness and learning achievement of students with different self-regulated learning. International Journal of Emerging Technologies in Learning (iJET), 16(3), 36-56.
21. Alvi, E., & Gillies, R. M. 2020. Teachers and the teaching of self-regulated learning (SRL): The emergence of an integrative, ecological model of SRL-in-context. Education Sciences, 10(4), 98.
22. Cleary, T. J., Velardi, B., & Schnaidman, B. 2017. Effects of the Self-Regulation Empowerment Program (SREP) on middle school students' strategic skills, self-efficacy, and mathematics achievement. Journal of school psychology, 64, 28-42.
23. Porter, A. N., & Peters-Burton, E. E. 2021. Investigating teacher development of self-regulated learning skills in secondary science students. Teaching and Teacher Education, 105, 103403.
24. Hidajat, F. A. 2022. Self-Regulated Learning for Creative Mathematics Teaching to Secondary School Students Through Mobile E-Learning Applications. International Journal of Interactive Mobile Technologies, 16(19).
25. Panadero, E. 2017. A review of self-regulated learning: Six models and four directions for research. Frontiers in psychology, 422.
26. Zimmerman, B. J., & Moylan, A. R. 2009. Self-regulation: Where metacognition and motivation intersect. In Handbook of metacognition in education (pp. 299-315). Routledge.
27. Roberts, E. D., Tadlock, J., & Zumbrunn, S. 2011. Encouraging self-regulated learning in the classroom: A review of the literature. Metropolitan Educational Research Consortium.
28. Alvi, E., & Gillies, R. M. 2020. Teachers and the teaching of self-regulated learning (SRL): The emergence of an integrative, ecological model of SRL-in-context. Education Sciences, 10(4), 98.
29. Roberts, E. D., Tadlock, J., & Zumbrunn, S. 2011. Encouraging self-regulated learning in the classroom: A review of the literature. Metropolitan Educational Research Consortium.