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Implementation of Deep Learning through the 5E Cycle Learning Model on Population Problems Material

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Abstract: The low achievement in Geography on the topic of population issues among students in Class XI-2 at SMA Islam Nusantara prompted the implementation of the Deep Learning approach through the 5E Cycle model. This study aims to describe the implementation of the Deep Learning approach through the 5E Cycle model in improving student achievement. The method used was Classroom Action Research (CAR) consisting of two cycles, which included the planning, implementation, observation, and reflection stages. Data collection was conducted using observation sheets and pre-test and post-test questions. The results showed a consistent increase in the average learning achievement score, from 74 in the pre-cycle to 81 in Cycle I, and reaching 87 in Cycle II. Additionally, the implementation of the Deep Learning approach increased by 0.86, while the implementation of the 5E Cycle model increased by 1.48. Significant differences were observed in Cycle II, where students demonstrated deeper analytical skills and higher levels of independent learning, though they were still in the adaptation phase. Future researchers are advised to implement this collaborative method across a broader scope of geography material to test its long-term effectiveness.

Keywords: deep learning; 5E cycle learning; learning outcomes; geography

INTRODUCTION

Indonesia is experiencing very rapid population growth. This acceleration in population growth will impact various aspects of life, including social, economic, political, and cultural aspects (Puspita Sari et al., 2023). According to data from the Central Statistics Agency (BPS), Indonesia's population as of mid-2024 stood at 281.6 million people. This places Indonesia fourth among the world's most populous countries (Sitorus & Hutasoit, 2021). This high population growth can also lead to demographic issues. Demographic issues are not merely statistical figures but complex challenges that encompass societal well-being. Well-being is not determined solely by the size of an individual's income but also by economic, educational, and health disparities (Mu'awwanah et al., 2022). In the context of education, the field of geography plays a crucial role in developing an understanding of spatial and educational phenomena. In the geography curriculum, the topic "Population as a Human Resource" is part of the development of material on the anthroposphere. This material is taught in 11th grade or

Phase F during the even semester. One of the topics covered is population issues. Teachers encourage students to understand population issues to foster attitudes and awareness regarding the importance of understanding these issues on a small scale, such as the demographic conditions in the students' local communities (Ulfah, 2021).

The reality on the arround is that geography instruction covering population topics has not been effective enough in enhancing students' thinking skills, particularly those related to analytical and critical thinking abilities. Teachers still rely on school textbooks to teach population-related topics, which inevitably makes learning activities monotonous and reduces students' interest in learning (Nurin Shabrina et al., 2023). This hinders active engagement in the classroom. Therefore, there is a need to implement a learning approach that can boost students' motivation and proactivity to achieve a deeper understanding. Based on observations at SMA Islam Nusantara, students' learning outcomes in geography have not yet met the established achievement standards. Students' low interest in learning geography results in a less-than-optimal learning process and negatively impacts their learning outcomes. Teachers still focus on helping students understand the material and guiding them through the learning process before students engage in independent learning activities.

Previous studies have explored the use of interactive learning models. Research conducted by Harizah (2022) found that active learning models, such as *Project-Based Learning* (PjBL), have a significant impact on geography learning outcomes, with a focus on the model's effectiveness through experimental methods to assess final cognitive outcomes. Additionally, a prior study by Noviantoro (2020) sought to enhance students' motivation and independent learning in through structured assignments method. However, no research has specifically integrated a learning model with philosophical-emotional dimensions, such as the Deep Learning approach.

As a strategic step to address known issues in geography learning, this studyapplies the Deep Learning approach through the 5E *Cycle* model (*Engage, Explore, Explain, Elaborate, Evaluate)*. The integration of the Deep Learning approach with the 5E *Cycle* learning model is grounded in humanistic learning theory, and it is expected to enhance students' enthusiasm for learning and lead to positive learning outcomes. This aligns with research conducted by Putra (2024), which found that the implementation of the 5E *Cycle* learning model was proven to successfully improve student learning outcomes, with an average score of 82 that met the mastery criteria. This success was also demonstrated by increased student motivation and engagement, enabling them to produce works that reflected their understanding.

The education system in Indonesia has undergone changes in its curriculum structure by incorporating a learning approach known as *Deep Learning*. In an educational context, *Deep Learning* refers to a form of learning process that is holistic and comprehensive. The *Deep Learning* approach focuses more on students' deeper understanding of learning materials and the development of their thinking skills, which are oriented toward analysis, synthesis, and evaluation (Wijaya et al., 2025).

According to Sawyer, there are six components of Deep Learning, including: (1) connecting new ideas and concepts to prior knowledge and experiences, (2) integrating knowledge into an interconnected conceptual system, (3) identifying underlying patterns and principles, (4) evaluating new ideas and their connections and drawing conclusions, (5) understanding the discussion process involved in developing their knowledge and critically examining the logical arguments, and (6) reflecting on their understanding of the learning process independently (Kenna, 2023). According to Fulan (2018), *Deep*

Learning is the process of acquiring six global competencies, including *character*, *citizenship*, *collaboration*, *communication*, *creativity*, and *critical thinking*.

Therefore, *Deep Learning* is an attractive approach to implement in education in Indonesia. Terminologically, the term *"Deep Learning"* is referred to as "Pembelajaran Mendalam" (PM), a term that is officially used in the Indonesian educational context. By definition, Pembelajaran Mendalam is an approach that prioritizes the creation of a learning environment and learning process *that is mindful*, *meaningful*, and *joyful* through intellectual, emotional development (ethics), aesthetic development (aesthetics), and physical development (kinesthetics) in a holistic and integrated manner (Puskurjar, 2025).

The implementation of Deep Learning (DL) requires a learning model to facilitate the learning process. Teachers can use more constructive learning models to support the achievement of Deep Learning, and students can develop their understanding. Students do not merely receive information from the teacher but are able to build active mental awareness of learning through their own cognitive maturity (Masgumeler & Mustafa, 2021). The *5E Cycle* Learning Model is a constructivist learning model.

The foundation of the *5E* Learning *Cycle* Model is based on Piaget's constructivist view that students are capable of independently constructing their knowledge through their environment (Riski Pratama et al., 2023) . This learning model consists of five phases or stages: *engage*, *explore*, *explain, elaborate, and evaluate* (Garcia I Grau et al., 2021). A key advantage of this model is its ability to enhance students' interest and motivation in learning, as its structure actively engages students and makes learning more meaningful (Koce Matitaputty & Sopacua, 2023)

Based on the above discussion, it can be concluded that the urgency of this study lies in the ongoing transformation of geography instruction by teachers, aimed at improving the quality of learning and positively impacting students. The implementation of Deep Learning (DL), which emphasizes the aspects of understanding, applying, and reflecting, can be maximized by combining it with the *5E Cycle* learning model in geography lessons on population issues. The objective of this study is to determine the effectiveness of applying *Deep Learning* through the *5E Cycle* learning model to population issues to improve student learning outcomes.

METHOD

This study is a Classroom Action Research (CAR) conducted over 2 cycles with 4 sessions. Each cycle included the stages of planning, implementation, observation, and reflection (Purwanto et al., 2025). The CTL study on the application of the *Deep Learning* approach through the 5E *Cycle* learning model was carried out using several stages from the theory of Kemmis and McTaggart, whose cycle model is spiral-shaped (Utomo et al., 2024). This study was conducted in Class XI-2 at SMA Islam Nusantara during the 2024/2025 academic year with a total of 12 students, consisting of 5 male and 7 female students. The researcher chose to conduct this action research at this school due to the problem of low achievement in geography and a lack of understanding of the subject matter.

The planning stage involved the development of Teaching Modules (MA) consisting of learning steps, learning resources, worksheets, and research instruments that incorporated the application of the *Deep Learning* approach using the 5E *Cycle* learning model in the Geography subject, specifically on the topic of Population Dynamics (subtopic: Population Issues). The Classroom Action Research model used is shown in Figure 1.

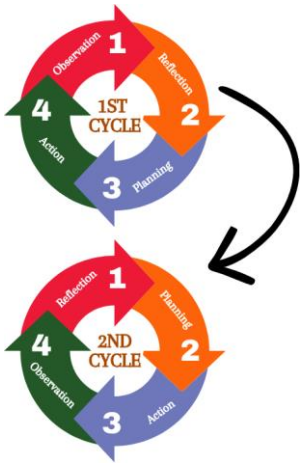

Figure 1. Diagram of the Two-Cycle Classroom Action Research

The research instruments used were observation sheets, test questions (*pretest and posttest*) consisting of 20 items (15 multiple-choice questions and 5 essay questions), and documentation. Data collection techniques included observation and testing. The observation sheet was used by the teacher to observe students during the action phase, and the test questions were administered before the action phase as *a pretest* and after the action phase as *a posttest* at the end of each cycle. Data analysis and the drawing of conclusions regarding the implementation of *Deep Learning* through the 5E Learning *Cycle* model were conducted through scoring. Meanwhile, analysis of learning outcomes was carried out during the reflection phase at the end of each cycle, and a calculation of class-wide mastery was performed after determining the average score and students' learning outcomes. The following outlines how to analyze students' learning outcomes both individually and as a class.

(i) $Individual\ Completion = \frac{total\ score\ obtained}{maximum\ score}\ x\ 100\%$

(ii) $Classical\ Completeness = \frac{Number\ of\ students\ who\ obtained \geq 78}{number\ of\ students}\ x\ 100\%$

Source: Kahar (2020).

An indicator of success in this CAR is an increase in student learning outcomes from Cycle I to Cycle II, based on the established Learning Objective Mastery Criteria (KKTP) for the Geography subject, which is set at 78. The following table shows the criteria for student learning outcomes.

Table 1. Student Learning Outcome Criteria

Percentage (%)	Description
85–100	Very High
70–84	High
50–69	Moderate
30–49	Low
0–29	Very Low

Source: Arumsari (2023)

RESULTS AND DISCUSSION

Results

The following is a summary of the results of the intervention in the form of student learning outcomes from the implementation of *Deep Learning* through the 5E *Cycle*

learning model in the pre-cycle, Cycle 1, and Cycle 2, as shown in Table 3 below.

Table 3. Comparison of Student Learning Outcomes from the Pre-Cycle to Cycle I

Notes	Results		
	Pre-Cycle	Cycle I	Cycle II
Highest Score	80	85	87
Lowest Score	60	72	75
Average	74	81	87
Students Who Met the Standard	5	10	12
Students Who Did Not Pass	7	2	0

A summary of the comparative data on students' learning achievement by class in Cycle I and Cycle II is presented in Table 4 below.

Table 4. Comparison of Students' Classical Mastery Rates in Cycle I and Cycle II

Classical Mastery (%)	Cycle I	Cycle II	Increase (%)	Notes
Learning Outcomes	83	92	8	Increased

A summary of the data from the researcher's observations of students regarding the implementation *of deep learning* in Cycle I and Cycle II is presented in Table 5 below.

Table 5. Comparison of the Average Implementation *of Deep Learning* in Cycle I and Cycle II

No.	Aspects of *Deep Learning*	Cycle I	Cycle II	Improvement	Notes
1.	Meaningful	2.67	3.75	1.08	Increasing
2.	Conscious	2.58	3.33	0.75	Increasing
3.	Encouraging	3.00	3.75	0.75	Increasing
	Average	2.75	3.61	0.86	Increasing

A summary of the data from the researcher's observations of students regarding the implementation of the 5E *Cycle* learning model in Cycle I and Cycle II is presented in Table 6 below.

Table 6. Comparison of the Average Implementation of the 5E *Cycle* Learning Model in Cycle I and Cycle II

No.	5E Stages	Cycle I	Cycle II	Improvement	Notes
1.	Eng*age*	2.08	3.50	1.42	Increasing
2.	*Explore* (search)	1.92	3.33	1.41	Increasing
3.	*Explain* (explanation)	1.58	3.17	1.59	Increasing
4.	*Elaborate* (elaboration)	1.58	3.00	1.42	Increasing
5.	Ev*aluate*	1.75	3.33	1.58	Increasing
	Average	1.79	3.27	1.48	Increasing

Based on the results of observations and the implementation of instruction using *deep learning* through the 5E *Cycle* model on the topic of population issues, reflections were obtained for Cycle I and Cycle II.

The reflections from Cycle I and Cycle II revealed significant transformations in the geography learning process. In Cycle I, it was found that students still tended to be passive within their groups and felt bored with the conventional classroom atmosphere, resulting in less in-depth completion of worksheets and an evaluation phase that was perceived as less challenging. However, following the intervention in Cycle II, there was a significant increase in enthusiasm due to the shift of learning spaces outside the

classroom, which made students more independent in seeking information and more confident in expressing their opinions. The final results showed that a culture of reflection began to take shape, in which students were able to conduct sharper and more in-depth analyses of the material studied.

Cycle 1 still utilized a conventional classroom setting that fostered boredom, whereas Cycle 2 moved learning activities to the schoolyard and gazebo to create a more refreshing (*joyful*) atmosphere. In Cycle 1, students tended to be passive and shy about expressing their ideas. In contrast, in Cycle 2, students became more active, enthusiastic, and independent in exploring learning resources from the internet. The results of the worksheet completion in Cycle 1 were considered insufficiently in-depth. In Cycle 2, the quality of analysis and evaluation improved significantly due to the use of more structured and interactive worksheet guidelines. Cycle 1 did not yet demonstrate a strong culture of reflection, whereas in Cycle 2, the use of "Reflection Cards" helped students build the courage to share their findings, even if they were not yet perfect.

The move to the gazebo was made because the monotonous classroom atmosphere hindered students' motivation to learn. This was intended to foster a sense of joy in deep learning. The worksheets were revised by adding clearer instructions and providing internet access, as students had difficulty exploring the material in depth during the initial cycle. The use of reflection cards was implemented as a solution to students' passive attitudes and shyness in expressing their opinions, thereby creating a *mindful* learning environment. The researcher felt that the "elaborate" and "evaluate" stages in the first cycle were not challenging enough; therefore, the intervention in the second cycle was designed to maximize these two stages so that learning outcomes would improve significantly. The following is documentation of the classroom action implementing *Deep Learning* through the 5E learning *cycle* model on the topic of population issues in Cycle I and Cycle II.

Figure 2A. The teacher facilitates group discussion, 2B. The teacher reinforces students' findings to deepen their understanding, 2C. Reflection session with students, 2D. Students engage in elaboration with other groups, 2E–F. Students learn outside the classroom to create a more enjoyable learning atmosphere.

Based on the results of this study, the findings indicate that in the pre-cycle stage, the average learning achievement score was 74, with a very low classical mastery rate of only 42%. In Cycle I, following the initial intervention, the average score increased to 81, with the classical mastery rate reaching 83%. Although these scores exceeded the minimum competency standard (KKTP), observations indicated that students still tended to be passive during group discussions. In Cycle II-the final cycle serving as a remedial strategy-the average score jumped to 87, with a classical mastery rate of 92%. This represents an 8% increase in mastery compared to the previous cycle.

The implementation of Deep Learning showed that the average implementation of the Deep Learning principles (*Mindful, Meaningful, Joyful)* increased by 0.86 points. The "Meaningful" principle recorded the highest increase at 1.08, as students began to be able to relate population theory to the realities in their environment. The implementation of *the* 5E learning model was carried out with a significantly more complete syntax, increasing by 1.48 points. The most noticeable improvement was in the *"Explain"* and *"Elaborate"* stages, where the teacher provided more space for students to independently explore learning resources from the internet.

Following the implementation of the deep learning approach using the 5E *Cycle* model, significant changes were observed among the students. In Cycle I, student boredom resulting from the conventional classroom atmosphere was addressed in Cycle II by moving the learning location to the schoolyard and the gazebo. This change created a *joyful* learning atmosphere and increased student engagement in group work. The use of reflection cards in Cycle II successfully encouraged students to acknowledge their learning obstacles and appreciate their peers' insights. This culture of reflection made the learning process more *mindful*, where students not only focused on completing tasks but also sought to understand the essence of the material being studied. In Cycle II, the use of more structured worksheets and the integration of interactive games made students' analysis of demographic data more precise and in-depth compared to Cycle I.

Discussion

Cycle I was conducted on April 16 and 23, 2025, and Cycle II was conducted on May 7 and 9, 2025, at SMA Islam Nusantara (SMAINUS). The research was conducted based on the identified problem: a lack of active student engagement in learning, which makes it difficult for students to develop their understanding and causes them to rely on

the teacher's explanations; this, in turn, impacts students' learning outcomes. According to Siregar (2022), students who are actively engaged serve as a driving factor in building their understanding of the material they are studying. Students who tend to be passive in the classroom have limited ability to understand the material and apply it. Low student engagement in the learning process also results in low learning outcomes, and students tend to rely solely on the teacher's explanations (Zuschaiya, 2024). To address this issue and enhance students' active engagement in learning as well as their learning outcomes, this study applies *Deep Learning* through the 5E *Cycle* model in geography instruction, with a focus on population issues.

Deep Learning, as applied in the classroom, emphasizes the principles *of meaningfulness*, *mindfulness*, and *joyfulness*, with the goal of helping students become more active in their learning, feel confident in expressing their understanding, and create a more enjoyable learning environment. Students who are conscious of their need to acquire knowledge and skills can be described as lifelong learners; they will also actively make connections, analyze, and relate the information they seek to real-life situations, thereby motivating them to learn, hone their creativity, and fulfill their personal needs (Puskurjar, 2025). In relation to *Deep Learning* as a learning approach, teachers use instructional models that enrich classroom learning activities to complement it. The instructional model used in this study is *the* 5E *Learning Cycle*, which focuses on five stages: *engage, explore, explain, elaborate,* and *evaluate*. This model helps students develop mastery of subject concepts through hands-on activities conducted sin stages, enabling them to discover new concepts and apply them to solve problems, thereby making students more active in their learning (Pratama et al., 2022). Therefore, the integration of *Deep Learning* with the *5E Cycle* learning model is applied to address challenges in geography instruction.

Student learning outcomes showed improvement from the pre-cycle to Cycle II, after implementing *Deep Learning* through the 5E *Cycle* learning model. Student learning outcomes in the pre-cycle stage averaged 74, with 5 students meeting the standards and 7 students not meeting the standards. This was because the students were not yet accustomed to and needed to adapt to a learning method that required them to understand the concepts of the material in depth and to think critically and analytically. The initial intervention through the implementation of *Deep Learning* using the 5E *Cycle* model in Cycle I resulted in an improvement in student learning outcomes, with an average score of 81, the number of students who met the criteria increasing to 10, and 2 students who did not meet the criteria. The change in student learning outcomes from the pre-cycle to Cycle I indicates that students are beginning to analyze and critically evaluate population issues in a more in-depth geography learning context; however, teachers play a crucial role in guiding students throughout this learning process. Learning that incorporates case studies and a step-by-step reasoning process within the cyclical learning approach has the potential to reinforce conceptual understanding and enhance students' critical thinking skills (Andayani et al., 2022; Anjani et al., 2020). Learning engagement is not merely measured by students' cognitive understanding of the material but also by their ability to self-regulate and apply that understanding to contribute to solving problems in their surroundings.

Reflections from Cycle I serve as the basis for improving instruction to be implemented in Cycle II. The improvement in student learning outcomes from Cycle I to Cycle II is evident in an average score of 87, with all students achieving mastery. Based on the views of Kelana & Wardani (2021), who assert that when the 5E *Cycle* learning

model is consistently implemented in the classroom, it trains students to think critically and analytically and motivates them to be active participants in the learning process. In a modern context, the term *"Deep Learning"* is not limited to technology but can also serve as a pedagogical strategy to encourage students to deepen their understanding through activities involving deep reflection and analysis (Muzakir et al., 2024). The improvement in student learning outcomes across each cycle in this classroom action research indicates that challenges in geography instruction can be addressed through the synergy of the 5E *Cycle* learning model combined with *the Deep Learning* approach, which emphasizes active, meaningful, and reflective learning processes.

In Cycle I, during the *"engage"* and *"explore"* stages, students began to feel motivated to learn about and understand issues related to population, and they were also able to cite one example of a population-related problem in their neighborhood. This aligns with research by Pallawa (2023), which found that *the "Engage"* stage provides students with the opportunity to connect the new knowledge and understanding they have acquired to the given case studies, while the "Explore" stage involves students actively analyzing the case studies they are studying in depth and in detail. The *"engage"* and *"explore"* stages in the 5E *Cycle* learning model align with the principles *of Deep Learning*, where these two stages serve as the foundation for students to think *mindfully* and *meaningfully* when understanding data or information (Setyosari et al., 2023). During the *"Engage"* stage, students are motivated to develop an interest in learning; then, during the *"Explore"* stage, the teacher involves students in the inquiry process, either through the internet or through independent observation activities conducted by the students themselves (Putra et al., 2024b). These two stages, when carried out effectively, constitute the most important elements of Deep Learning.

In the *"Engage"* stage, the teacher presents images and videos of population issues such as poverty, slums, and crime, and shares unemployment data with the students. Students are asked to discuss and present their arguments or opinions in groups to analyze these population issues. The success of this *"Engage"* phase is evident from observations showing that students are highly enthusiastic about learning. The advantage of the *"Engage"* phase at the beginning of the lesson is that it improves theoretical understanding and reduces conceptual misconceptions regarding the material studied by students (Rejeki et al., 2026). Next, after the *"engage"* phase is complete, the teacher distributes worksheets to students so they can discuss and search for supporting data to strengthen their arguments in analyzing population issues; this phase is called *the "explore"* phase. The initial learning strategy, which emphasizes the *"engage"* and *"explore"* phases, creates a combination that has a tangible impact on strengthening analytical skills (Rejeki et al., 2026). This is evidenced by the results of student observations in Cycle I and Cycle II, which show that the *"engage"* stage had an average implementation score of 2.08 (Cycle I), increasing to 3.50 (Cycle II) on a scale of 4.00, while the *"explore"* stage had a score of 1.92 (Cycle I), increasing to 3.33 (Cycle II) on a scale of 4.00. This indicates that students' learning activities have reached a deeper level but still require guidance from the teacher.

In the *"explain"* stage, students present the findings they have discussed with their groups. The *"elaborate"* stage involves in-depth discussions with the teacher on population issues, and the teacher helps verify the students' findings. The *"Evaluate"* stage is the final stage of learning, during which the teacher administers a *post-test* to measure students' understanding. Overall, the implementation of *deep learning* through the 5E *Cycle* model is able to improve student learning outcomes. This is consistent with

the findings of a study by Zaroh (2025), which concluded that the 5E *Cycle* model is quite effective in helping students understand learning material and develop their argumentation skills. The application of the 5E *Cycle* learning model reduces misconceptions, fosters a strong sense of curiosity, enhances a sense of responsibility, and improves reflective thinking skills (Rejeki et al., 2026). Based on the research results and field findings, this study aligns with the constructivist theories of Piaget and Vygotsky. These theories emphasize that students play an active role in the learning process, actively develop their knowledge, and are responsible for their own learning (Azzahra et al., 2025).

CONCLUSION

The implementation of geography instruction on population issues using *Deep Learning* through the 5E *Cycle* model can improve student learning outcomes and motivate students to be active in the learning process, as well as help students develop critical, analytical, and creative thinking skills derived from the meaningfulness of their learning and their awareness of the importance of learning among 11th-grade students in Class XI-2 at SMA Islam Nusantara. As a suggestion for other researchers, this study has certain limitations. The implementation *of Deep Learning* requires further research to optimize students' adaptation to this learning approach. The primary hope is the creation of a culture of independent learning in which students are consciously able to construct their own knowledge without dominant teacher assistance, leading to improved learning outcomes.

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