

IMPLEMENTATION OF THE RADEC MODEL WITH FLIPPED CLASSROOM STRATEGY ASSISTED WITH WORDWALL APPLICATION TO REDUCE MISCONCEPTIONS OF CLASS VII-A STUDENTS UPT SMPN 14 GRESIK

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Abstract

This research aims to reduce students' misconceptions about the Earth and Solar System subject by implementing the RADEC model using a flipped classroom strategy assisted by the Wordwall application. This study is a Classroom Action Research (CAR) that adopts the Kemmis and McTaggart design. The research was conducted in two cycles, each consisting of four components: planning, action, observation, and reflection. The study was conducted in Class VII-A of UPT SMPN 14 Gresik, which consisted of 30 students. Data was collected through classroom observations, student reflections, and a four-tier diagnostic test. Data analysis was performed using qualitative descriptive analysis to describe changes in student misconceptions. The results of the first cycle showed that students' conceptions of the Earth and the Solar System were as follows: 60.33% had scientific conceptions, 16.33% lacked knowledge, and 23.33% had misconceptions. The results of the second cycle showed an improvement in students' scientific conceptions and a decrease in the lack of knowledge and misconceptions: 86.67% had scientific conceptions, 4.33% lacked knowledge, and 9.00% had misconceptions. It can be concluded that implementing the RADEC model with a flipped classroom strategy assisted by the Wordwall application can be an alternative solution to reduce students' misconceptions in science learning, especially Earth and the Solar System.

Keywords: *Flipped Classroom, RADEC Model, Misconceptions Reduction, Wordwall*

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INTRODUCTION

The nature of science learning as a product aims to provide students with an understanding of scientific concepts. The science aspect as a body of knowledge contains knowledge of facts, concepts, and principles (Fahmi et al., 2022), so through science learning, students are invited to critically and analytically explain various natural phenomena and symptoms with appropriate scientific concepts based on logical reasoning (Sutiani et al., 2021). Effective science learning allows students to build a deep understanding, explore scientific concepts, and identify recurring misconceptions (Mason & Zaccoletti, 2020). This can help students apply scientific knowledge every day. Thus, appropriate science learning strategies can spark students' interest in learning to explore various phenomena, problems, and scientific discoveries.

One of the main challenges in learning science is the problem of misconceptions experienced by students. Misconceptions in science learning are often encountered, including the subject matter of light and optics (Firansilady et al., 2022), temperature and heat (Rahayu et al., 2021), Newton's law (Huda et al., 2022), photosynthesis and plant respiration (Manurung et al., 2021), and the solar system (Febria et al., 2021). Misconceptions are a challenge in improving mastery of science concepts. Misconceptions often occur in science material which has abstract concepts. Misconceptions occur when students form an understanding not by scientific conceptions, which can be caused by inappropriate interpretations, wrong perceptions, or initial knowledge that is inappropriate and insufficient to understand scientific concepts (Uce & Ceyhan, 2019).

Misconceptions can be an obstacle to science learning. Low science learning outcomes indicate the impact of misconceptions experienced by students (Darwis & Hardiansyah, 2022). Persistent misconceptions cause students to find it difficult to relate and construct new knowledge based on scientific conceptions (Chen et al., 2019). Students' difficulties in new acquisitions are linked to the chain of science learning problems, such as hindering problem-solving and students' mistakes in applying science concepts. Furthermore, misconceptions can even cause failure in accepting and organizing new information into knowledge structures (Fahmi & Irhasyuarna, 2017). Therefore, it is essential to reduce science misconceptions so that students can understand concepts based on scientific conceptions.

The results of initial observations in class VII-A UPT SMPN 14 Gresik for the 2022/2023 academic year show that students also experience misconceptions about the subject matter of the Earth and the solar

system. Pre-research preliminary data revealed that the level of student misconceptions was high, namely 43.34%. In connection with these findings, efforts to reduce misconceptions in science learning, especially the primary material of the Earth and the solar system in class VII-A UPT SMPN 14 Gresik, need to be carried out. This is urgent so that students can understand the concepts of Earth and the solar system according to correct scientific conceptions and overcome students' learning difficulties in this material.

Reducing student misconceptions in science learning can be done by implementing student-oriented learning. Silalahi & Hutauruk (2020) revealed that active student learning allows students to build understanding and awareness of learning. Eliminating student misconceptions will be too difficult if done through traditional learning methods because students build their knowledge and concepts according to their abilities and experience (Uce & Ceyhan, 2019). Student-centred learning is an example of learning according to constructivism theory, so it can be a solution to reduce misconceptions. Previous research used student-centred learning models such as guided discovery learning (Admoko et al., 2019), 5E learning cycle (Salyani et al., 2020), guided inquiry (Pikoli, 2020), and RADEC (Siregar et al., 2020) is reported to be able to reduce student misconceptions.

To overcome the problem of student misconceptions, this research uses the RADEC learning model. This model comprises five syntaxes: read, answer, discuss, explain, and create. The RADEC model can promote conceptual change through the learning stages from reading to creating as the actualization of understanding (Banawi et al., 2022). The RADEC model is a learning model that is easy to apply to increase student involvement and the quality of learning that suits the student's situation and conditions (Martinopa & Amini, 2023). The research results of Sujana et al. (2021) reported that no students experienced misconceptions after implementing the RADEC model, and there was an actual increase in concept mastery. In addition, the RADEC model has flexible learning stages that can be adapted to various strategies and media (Ilham et al., 2020) so that the application of the RADEC model in this research can be adjusted to students' needs and problems.

The results of previous research on the flipped classroom strategy can be applied to overcome student misconceptions (Linda, 2021). The RADEC model is a model that can be applied with a flipped classroom strategy so that during face-to-face learning, students can focus on learning to validate knowledge, strengthen understanding of the material, and straighten out inaccurate conceptions (Samsudin & Firdaus, 2022). Thus, implementing the RADEC model with a flipped classroom strategy can optimize students' ability to construct knowledge according to scientific conceptions. Considering that factors of interest and motivation can also cause misconceptions about learning (Rohmah et al., 2023), learning science should be fun. One effort to provide fun learning is using applications to facilitate game-based learning, such as Wordwall (Safitri et al., 2022). Learning with educational games can increase student involvement in learning concepts with fun activities (Prott & Ebner, 2020).

Based on the things stated above, it is essential to overcome the problem of misconceptions about Earth and the solar system. This classroom action research aims to reduce misconceptions through learning designs centred on fun student activities. Therefore, this classroom action research aims to describe the process and results of implementing the RADEC model with the flipped classroom strategy assisted by the Wordwall application to reduce the misconceptions of class VII-A students at UPT SMPN 14 Gresik regarding the Earth and solar system.

METHOD

This research is classroom action research (CAR), which adopts a design according to Kemmis and Mc Taggart. The research was carried out at UPT SMPN 14 Gresik in May – June of the 2022/2023 academic year, where the research subjects were 30 students in class VII-A. This research was carried out in two cycles, namely cycle I and cycle II, with each cycle consisting of 4 components, namely planning, action, observation, and reflection. Figure 1 shows the design of the classroom action research cycle (Linda, 2021).

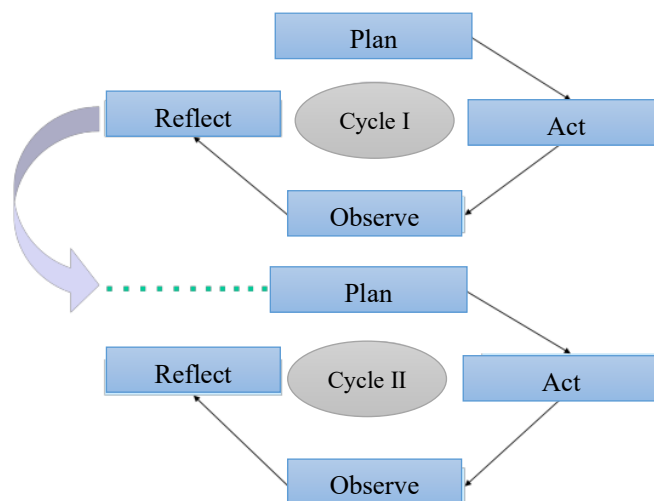


Figure 1. Classroom Action Research Cycle Design

The classroom action research procedure refers to the design in Figure 1. Generally, the planning stage is carried out by compiling learning tools for the Earth and the solar system, including teaching modules, student worksheets, and teaching materials using the RADEC model (Read, Answer, Discuss, Explain, Create) combined with the flipped classroom learning strategy. Apart from learning tools, at this planning stage, we also prepare learning media with the Wordwall application and prepare a four-tier diagnostic test to determine changes in student misconceptions. In the action stage, learning is carried out using the Earth and solar system teaching modules prepared in the previous stage. The observation stage is carried out at the same time as the action is given, namely with the help of observers to determine the implementation of learning and observe changes in students' misconceptions revealed through administering four-tier diagnostic tests. The reflection stage is carried out by evaluating and analyzing data on changes in student misconceptions and reflecting on the implementation of actions taken. The results of the reflection in cycle I become the reference focus for improvements made in cycle II.

This classroom action research collected data through classroom observations, student reflections, and four-tier diagnostic tests. Class observations are carried out by peer observers using observation sheets. Students carry out student reflection by writing down the results of reflections on the implementation of learning that has been carried out using reflection sheets. A four-tier diagnostic test was given to students to obtain data about students' misconceptions before the research and after implementing the action. The results of the four-tier diagnostic test are analyzed by providing a decision on the profile of students' conceptions about the Earth and the solar system, namely scientific conceptions, lack of knowledge, and misconceptions (false positives, false negatives, and pure misconceptions) (Yuzianah & Fatimah, 2022). Decision-making based on the results of the four-tier diagnostic test refers to the criteria in Table 1.

The data analysis technique in this research was carried out using descriptive qualitative. Data analysis emphasizes processes originating from observations from peer observers, student reflections, field notes obtained by researchers, and evaluation results of four-tier diagnostic tests. The PTK success indicator refers to classical completeness of no less than 85% for the concept understanding profile of concepts in Earth and solar system material, where individually, the concept understanding profile is declared complete if it is not less than 75%. Data analysis was also carried out to describe changes in student misconceptions due to implementing the RADEC model with the flipped classroom strategy assisted by the Wordwall application.

Tabel 1. Kriteria Interpretasi Jawaban pada Tes Diagnostik *Four Tier*

| Tier 1 | Tier 2 | Tier 3 | Tier 4 | Conceptions Profile |
|--------|----------|--------|----------|-----------------------|
| True | Sure | True | Sure | Scientific conception |
| True | Sure | True | Not sure | |
| True | Not sure | True | Sure | |
| True | Not sure | True | Not sure | |
| True | Sure | False | Not sure | Lack of knowledge |
| True | Not sure | False | Sure | |
| True | Not sure | False | Not sure | |
| False | Sure | True | Not sure | |
| False | Not sure | True | Sure | |

| | | | | |
|-------|----------|-------|----------|--------------------|
| False | Not sure | True | Not sure | |
| False | Sure | False | Not sure | |
| False | Not sure | False | Sure | |
| False | Not sure | False | Not sure | |
| True | Sure | False | Sure | False positive |
| False | Sure | True | Sure | False negative |
| False | Sure | False | Sure | Pure misconception |

Source: Gurel *et al.* (2015)

RESULTS AND DISCUSSIONS

Before entering the PTK cycle, a four-tier diagnostic test was carried out before the research cycle to discover student misconception problems in class VII-A UPT SMPN 14 Gresik. The results of identifying student conception profiles show a misconception level of 43.34%, consisting of 18.00% false positives, 4.67% false negatives, and 20.67% pure misconceptions (Figure 2). Identification of the level of scientific conceptions has the lowest percentage compared to other conception profiles. This shows that VII-A students' understanding of scientific concepts regarding the Earth and solar system at UPT SMPN 14 Gresik is still low. This high level of misconception indicates that the student's knowledge and understanding are wrong, but they believe it to be correct. In line with Supriatna *et al.* (2019), a pre-research conception profile on the solar system was also identified, and the level of student misconceptions was relatively high.

Based on the problems found, efforts must be made to reduce these misconceptions. Efforts to reduce misconceptions will directly impact increasing mastery of the understanding of scientific concepts regarding the Earth and solar system. This is because misconceptions can occur due to students still carrying learning experiences at the previous level, where these experiences contain things that are not scientific concepts (Chew & Cerbin, 2020). Thus, this classroom action research was carried out, and discussions with teachers and colleagues were begun to determine the action strategies that would be used to overcome these misconceptions.

Results and Discussion of Cycle I

In cycle I, the action strategy for reducing students' misconceptions regarding Earth and solar system material is applying the RADEC model with the flipped classroom learning strategy assisted by the Wordwall application. The planning stage involves compiling learning tools, learning media, and assessment instruments. The flipped classroom learning strategy is integrated into the RADEC model by dividing the learning steps into three parts: twice asynchronously (before and after face-to-face in class on the WhatsApp group platform) and once synchronously (face-to-face in class). This strategy was applied both at the first and second meetings for cycle I. When reinforcing material, the Wordwall application will be used during synchronous learning and packaged in tournaments between groups.

The action phase was carried out in two meetings. The first meeting was held on May 16, 2023, and the second on May 17, 2023. The essential stages in implementing the RADEC learning model with the flipped classroom strategy assisted by the Wordwall application in cycle I are presented in Table 2.

Table 2. Essential Stages of Implementing Cycle I Learning Actions

| Learning Stages | Learning Implementation | Note |
|-----------------|---|--------------|
| R (read) | Students read the objectives, activity descriptions, and learning assessments that will be carried out. Students study material independently from learning resources, and media teachers share it via WhatsApp groups. | Asynchronous |
| A (answer) | The teacher provides trigger questions to stimulate students' thinking about studying the material. | Synchronous |
| D (discuss) | The teacher displays natural phenomena related to the material to spark student discussion activities. Students in groups discuss analyzing the results of the phenomena and problems presented in the student worksheets. | Synchronous |
| E (explain) | Students explain the results of discussions related to phenomena and problems presented in student worksheets, where during the presentation process, the results of discussions are confronted between groups. | Synchronous |

| | | |
|------------|---|--------------|
| | The teacher provides feedback on the discussion results for each group of students. | |
| | The teacher explains scientific concepts that students do not yet understand by linking them to the core material and misconceptions experienced by students. | |
| | The teacher provides material reinforcement with a tournament system between groups assisted by the Wordwall application (true-false) on concepts with a high level of misconception. | |
| C (create) | Students create writing, ideas and works as a form of actualizing the understanding obtained from the learning that has been carried out. | Asynchronous |

The main activities of students in class are discussions and explanations that focus on concepts that often have misconceptions. Discussions are presented through LKPD by analyzing phenomena and problems related to the material being studied. Apart from the main activities in Table 2, as a preliminary activity, teachers and students first link the concepts of Earth and the solar system studied with previous learning experiences and their relevance in everyday life. Meanwhile, as a closing activity, teachers and students reflected on implementing the learning during two cycle I meetings. Reflection at the first meeting is done orally; the teacher asks questions about experiences, feelings, and knowledge gained during learning activities. Meanwhile, at the second meeting, reflection activities were carried out in writing with reflection sheets that focused on students' responses to the learning process.

The observation stage in cycle I was carried out during the delivery of classroom actions. Researchers observe student activities in learning activities so that actions can be adjusted to real situations and conditions but still refer to the planning that has been carried out. Furthermore, observations of changes in students' misconceptions were discovered after analyzing the results of the diagnostic tests at the end of the second meeting. Meanwhile, observations made by peer observers focused on the implementation of learning by teachers and students. From the overall observation results, student activities were good enough to be actively involved in learning, and teacher activities in implementing the RADEC model with the flipped classroom strategy assisted by Wordwall were carried out well.

Based on the results of evaluation and reflection, after the actions in cycle 1, there were still students who experienced false positives, false negatives, and pure misconceptions (Figure 2). However, compared to the pre-cycle diagnostics, it is clear that there is an increase in scientific conception profiles, as well as a significant decrease in the percentage of profiles that lack knowledge and misconceptions. The increased scientific conceptions by 42.66%, initially from 17.67% to 60.33%. Furthermore, the percentage of those who lack knowledge decreased by 22.67%, initially from 39.00% to 16.33%. Reducing the percentage of student misconceptions regarding false positives by 7.67% (initially 18.00% to 10.33%); decreased false negatives by 2.00% (from 4.67% to 2.67%); and a decrease in pure misconceptions by 10.34% (from 20.67% to 10.33%). Thus, the cycle I result shows that applying the RADEC model with the flipped classroom strategy assisted by the Wordwall application can reduce the percentage of students' misconceptions about the Earth and solar system.

The results of the cycle I show that the RADEC model can be an appropriate learning model solution to reduce student misconceptions. The role of the activity of studying material in the read syntax and answering trigger questions in the answer syntax can stimulate students to understand basic concepts related to Earth and solar system material. In line with Sujana et al. (2021), the RADEC model can increase understanding of basic concepts following scientific conceptions and reduce misconceptions experienced by students. In addition, learning activities in syntax discussion and explanation can facilitate students in building and improving their understanding of scientific concepts through phenomena and problems integrated as discussion and presentation material. Discussing relevant phenomena in everyday life requires students to think critically and creatively (Sukardi et al., 2017), so applying the RADEC model in the first action cycle can help students build scientific representations and concepts of Earth and the solar system.

Applying the RADEC model in cycle I also directly impacted the increasing understanding of scientific concepts and decreased misconceptions students experienced. Learning planning in the first cycle is oriented towards student-centred learning. The results of the observations show that student activity involvement is good enough to participate in the entire learning according to the RADEC model. In line with Fuadi et al. (2021), applying the RADEC model refers to the implementation of constructivist learning theory

so that it can provide students with direct experience to build and understand various scientific concepts. This was also confirmed by Siregar et al. (2020) that after implementing the RADEC model, the misconceptions experienced by students were reduced, especially after explaining activities (explain syntax). In this class action, students' activities in explaining are carried out in turns to explain the results of their discussions and continue with each student providing responses and arguments to other groups and the teacher providing feedback on each process and result shown by students to strengthen and straighten out understanding of the concept so that it is in line with the scientific conception.

In implementing the actions in cycle I, learning using the RADEC model was implemented through a flipped classroom strategy so that face-to-face pre-learning activities were carried out asynchronously in each person's home. In line with Sukardi et al. (2021), pre-learning activities can make learning time in class more effective. Therefore, the flipped classroom strategy in cycle I help facilitate classroom learning, which focuses on discussing and explaining core material that students do not yet understand, straightens out previously acquired knowledge and learning experiences and strengthens understanding of concepts following scientific conceptions. Learning resources and media teachers share via WhatsApp groups during face-to-face pre-learning which can help students understand the material they will study in class. Towey et al. (2019) revealed that the flipped classroom strategy can increase learning effectiveness by providing various learning resources that can serve as references for students. Furthermore, Linda (2021) stated that using the flipped classroom strategy with a conceptual change approach can reduce students' misconceptions about salt hydrolysis material.

Actions in the learning cycle I assisted by Wordwall as part of implementing the RADEC model with the flipped classroom strategy are steps to create enjoyable learning. Learning activities using Wordwall are carried out at the explained stage to strengthen students' understanding of the concepts they have learned through inter-group tournament activities. In the Wordwall application, the teacher asks questions relevant to the misconceptions experienced by students so that strengthening the material can help straighten out students' conceptions that are still inaccurate. In line with Safitri et al. (2022), Wordwall provides interactive and fun learning, including science learning. Wordwall can be a means of learning digital educational games to increase students' interest in learning. Prott & Ebner (2020) stated that digital educational games can motivate and stimulate students' interest in learning by encouraging students to be involved in learning while playing.

Based on a series of processes and results from planning, actions, and observations in cycle I, this cycle I reflection focuses on finding the strengths and weaknesses of all the processes that have been carried out. The strengths found will be maintained for the implementation of the next cycle, while the weaknesses that emerge will become the focus for improvement. The results of the cycle I reflection are related to the advantages found, as follows: 1) A decrease in the percentage of misconceptions and an increase in students' understanding of concepts has been seen compared to before the classroom action research was carried out, 2) With the flipped classroom strategy implemented in the RADEC model, it can help students obtain initial information learning that will be carried out and essential concepts that will be studied in class, 3) With the help of the Wordwall application, learning will not be boring and increase student participation, and 4) Selecting phenomena and problems as material for discussion and explanation can help build students' understanding of concepts because it is relevant to everyday life.

The weakness in cycle I is related to the results of reducing misconceptions that have not yet achieved maximum results. This is because student involvement is still not evenly distributed during reading sessions at home and discussions in face-to-face learning. Students' unfamiliarity with learning that applies the RADEC model with the flipped classroom strategy is also a factor causing cycle I learning to be less conducive, so more intensive class mastery and teacher guidance are needed so that students are fully involved in learning. Apart from that, the application of educational games in explaining sessions using the Wordwall application has not obtained optimal results because the form of true-false questions confuses students. Therefore, based on the reflection results of cycle I, further action is needed, namely cycle II, which optimizes the strengths and corrects the weaknesses of the implementation of cycle I actions.

Results and Discussion of Cycle II

The actions from cycle I showed that applying the RADEC model with the flipped classroom strategy assisted by the Wordwall application could reduce students' misconceptions about the Earth and solar system material. To improve efforts to reduce student misconceptions, the actions in cycle II use the same models, strategies, and media with slight improvements without changing the original essence or substance of the actions given in cycle I. Improvements to the actions in cycle II aim to optimize the reduction of results misconceptions, as well as to create more enjoyable learning and avoid the emergence of boredom among students in participating in science learning.

The planning stage of cycle II was carried out by re-planning the learning devices and media used. Improvement efforts when planning cycle II learning are based on the results of reflection in cycle I, namely: 1) syntax A (answering) is also carried out asynchronously which is integrated with learning resources and media distributed by the teacher, where students are asked to explore their knowledge by answering short questions to hone understanding of reading results before face to face in class, 2) discussion activities are designed with small group discussions where there is a clear division of tasks and roles for each student, 3) discussion and explanation activities are planned with simulation activities in accordance with LKPD as an additional learning resource to strengthen understanding the material, 4) changing the form of questions in the Wordwall application into a multiple choice form which is almost similar to the form of a diagnostic test, and 5) increasing the selection of natural phenomena or daily activities that are relevant to the material to be presented in learning. The learning planning in cycle II is designed for two learning meetings.

After planning for cycle II has been completed, the next stage is action, namely implementing the learning plan prepared in cycle II. In general, the implementation of cycle II actions follows the essential stages of cycle I in Table 2. The only different thing is the corrective action based on the learning plan that has been perfected, as well as actions to overcome the weaknesses of cycle I, namely by always motivating and guiding students, as well as increasing classroom conditioning efforts and effective learning management. All concepts studied by students are taught using the RADEC model learning steps with a flipped classroom strategy and with the help of the Wordwall application. In cycle II, the first meeting was held on May 30, 2023, and the second on May 31, 2023. The observation stage in cycle II was carried out during the delivery of class actions. Observations were carried out similarly in cycle I, both teacher and student observations in learning. From the overall observation results, the students' activities were well-involved in learning, and the teachers' activities in implementing the RADEC model with the flipped classroom strategy assisted by Wordwall were carried out very well.

Based on the results of evaluation and action reflection in cycle II, it is known that there has been an increase in the profile of student understanding of concepts and a decrease in student misconceptions compared to cycle I (Figure 2). Although some students still experience false positives, false negatives, and pure misconceptions, the percentage of each type of misconception is not more than 5.00%. The percentage of scientific conception profile increased from cycle I by 26.34% (from 60.33% to 86.67%). The decrease in the percentage of lacking knowledge from cycle I was 12.00% (from 16.33% to 4.33%), and the overall percentage of misconceptions from cycle I was 14.33% (from 23.33% to 9.00%). When broken down in the percentage of misconceptions, the reduction in false positives was 5.33% (from 10.33% to 5.00%) decreased false negatives by 1.67% (from 2.67% to 1.00%), and a decrease in pure misconceptions by 7.33% (from 10.33% to 3.00%). Thus, the actions in cycle II were proven to optimize the learning process and reduce student misconceptions by applying the RADEC model with the flipped classroom strategy assisted by the Wordwall application.

Improving actions in cycle II by providing pre-learning trigger questions can increase students' responsibility and involvement in learning the material. When face-to-face learning occurs, the teacher provides feedback on students' answers from reading activities at home, which increases from cycle I. In line with Pratama & Dewi (2022), giving pre-learning questions in the RADEC model can be used to see feedback from students at the reading stage so that asynchronous student activity can be detected. Apart from that, discussion activities during cycle II learning were carried out using small group discussions with a clear division of roles and responsibilities for each student. In one group, a group leader helps the teacher direct and guide student discussions according to the LKPD. This clear division of tasks overcomes the weakness of cycle I, where there are students who are still passive during discussions.

In cycle II, apart from watching videos of phenomena and problems relevant to everyday life, discussion activities include inviting students to carry out classical simulations as material for student discussion. The simulation presents concrete learning media such as a globe to imitate the Earth, a flashlight as the sun, and a small ball as the moon to help students learn abstract concepts in the Earth and solar system. Thus, the application of the RADEC model in cycle II can be adjusted to suit classroom needs without changing the essence of the learning. In line with Ilham et al. (2020), the RADEC model has flexible learning stages that can be combined with various strategies and media and can be applied offline, online, or blended.

In cycle II, student activities during the discussion stage were also carried out by discussing concepts that often had misconceptions. Discussion activities become more active when all students have a role in solving problems. Apart from that, discussions become more systematic because students are used to it and know what to do. Students are more confident in explaining the discussion results because they already have knowledge and feedback from the teacher regarding the reading and answering stages carried out pre-learning. Student-centred learning activities facilitate students in building better knowledge. The reinforcement of material from the teacher at the end of the explaining stage can straighten out students' conceptions that are

still inaccurate. Therefore, overall, the results of cycle II actions optimize the application of the RADEC model with the flipped classroom strategy, which is assisted by the Wordwall application in reducing student misconceptions.

Implementing classroom action strategies in cycle II reduced students' misconceptions, which were not lost due to improvements in learning plans. The RADEC learning model with the flipped classroom strategy requires students to be active as the main subject of learning in class. Using the Wordwall application packaged in inter-group tournaments provides fun science learning, thereby reducing student misconceptions. This aligns with Belova & Zowada (2020) that learning with games between groups is fun and can overcome various misconception problems. Furthermore, Salyani et al. (2020) believe active learning can help students interpret each learning process and improve their mastery of the concepts of the material being studied. Reducing misconceptions will be difficult if a traditional approach is applied, so the constructivist theory approach to learning is an effective solution (Uce & Ceyhan, 2019).

Cycle II reflection shows students are more active and evenly involved during learning. The increase in the scientific conception profile to 86.67% shows the success of implementing the RADEC model with the flipped classroom strategy assisted by the Wordwall application to reduce student misconceptions. All action improvement plans from cycle I reflection have been implemented well in cycle II so that the strengths of the previous process can be optimized and the weaknesses can be corrected. Apart from that, peer observations show that teachers' performance in mastering the class and students' management of learning is improving. All learning stages can be carried out consistently, and allocating science subject hours can be used well for learning activities. Based on the results of this reflection, the actions in cycle II can be stopped.

The description of Cycles of Change in Students' Conceptions

After describing each PTK cycle, the next step is to determine the success of the actions in this PTK cycle by reviewing changes in students' conceptions of the Earth and solar system. A review was also carried out on the classical completion and individual conceptual profiles of students before and after implementing the RADEC model with the flipped classroom strategy assisted by the Wordwall application. The results of changes in students' conceptions in this study are presented in Figure 2.

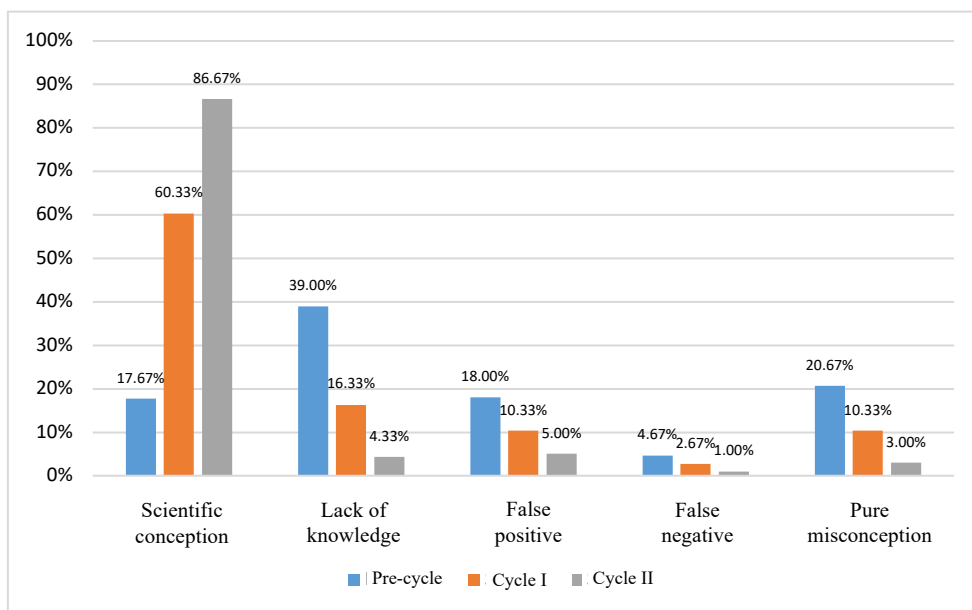


Figure 2. Graph of changes in students' conceptions between cycles

Based on Figure 2, it is known that changes in students' conceptions in class VII-A UPT SMPN 14 Gresik between cycles of this classroom action research. This shows that applying the RADEC model with the flipped classroom strategy assisted by the Wordwall application effectively reduces student misconceptions. Overall, there was an increase in scientific conception of 69% between before and after implementing the action. Apart from that, a real decrease in the percentage of lacking knowledge and misconceptions was also seen after the learning. The percentage of people who lacked knowledge of the concept decreased by 34.67%, while the overall decrease in the percentage of misconceptions was 34.34%. The reduction in the percentage of misconceptions in detail was 13.00% for false positives, 3.67% for false negatives, and 17.67% for pure misconceptions. As for learning completeness, which refers to classical and individual completeness for the concept understanding profile, it is presented in Table 3.

Table 3. Completeness of Students' Scientific Conception Profiles between Cycles

| Cycle | The number of students | | | Classical Completeness |
|-----------|------------------------|----------|------------|------------------------|
| | Total | Complete | Incomplete | |
| Pre-cycle | 30 | 0 | 30 | 0.00% |
| Cycle I | 30 | 11 | 19 | 36.67% |
| Cycle II | 30 | 26 | 4 | 86.67% |

The student's scientific conception profile experienced a real increase from pre-cycle to cycle II. At the end of cycle II, the percentage of individual concept understanding showed that 26 out of 30 students had a concept understanding level of no less than 75%. Thus, the final results of cycle II were declared successful because the classical concept understanding profile was no less than 85%. The achievements of classroom action research show that applying the RADEC model with the flipped classroom strategy assisted by the Wordwall application can reduce students' misconceptions in class VII-A UPT SMPN 14 Gresik regarding the Earth and solar system.

The success of the entire class action process in this research cannot be separated from the factor of active student engagement in the learning process. In line with Rohmawatiningsih et al. (2021), student performance during learning sessions is necessary to improve understanding of concepts that follow scientific conceptions. Utilizing relevant phenomena and problems in everyday life becomes a learning resource and discussion material for students to help them understand concepts. The application of the RADEC model provides students with the opportunity to read appropriate information from learning resources provided by the teacher and clarify understanding through discussion and explanation activities to reduce student misconceptions. The implementation of the flipped classroom strategy makes face-to-face learning more effective and the use of Wordwall in the design of tournaments between groups helps consolidate students' understanding of the concepts they are learning and makes learning fun.

CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

Based on the results and discussion in this research, it can be concluded that the application of the RADEC learning model with the flipped classroom strategy assisted by the Wordwall application is effective in reducing students' misconceptions about the Earth and solar system material. Apart from that, the class actions given can increase the profile of understanding the concept while reducing the profile of not understanding the concept. The results of the actions in cycle I showed an increase in student understanding of concepts and a decrease in student misconceptions from the pre-research cycle, namely 60.33% understood the concept, 16.33% did not understand the concept, and 23.33% had misconceptions. The results of actions in cycle II also showed an increase in students' conceptions and a decrease in the level of not understanding concepts and misconceptions, namely 86.67% understood concepts, 4.33% did not understand concepts, and 9.00% had misconceptions.

B. RECOMMENDATIONS

Based on the classroom action research that has been carried out, there are suggestions for further research, including the effectiveness of implementing the RADEC model with the flipped classroom strategy assisted by the Wordwall application to reduce misconceptions in other science materials. Further similar research can design actions that are given not only limited to two cycles but more than that to increase the number of students with a scientific conception profile of not less than 75% and classical completion reaching 100%. Meanwhile, selecting a diagnostic test with a higher tier, such as a five-tier diagnostic test can reveal the sources used by students in answering questions on the test instrument, and can be considered to find out the conception profile in more depth.

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