

EXPLORING THE TRENDS AND STRATEGIES OF PHYSICS MISCONCEPTION REMEDIATION: A SYSTEMATIC LITERATURE REVIEW

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Abstract :

Misconceptions in physics are very risky for learning, so a deep understanding of interventions to overcome Physics misconceptions is necessary. To accommodate this purpose, a review of physics misconception remediation efforts is necessary. So far, reviews on the remediation of Physics misconceptions are still limited. This research aims to describe: 1) the trend of Physics misconception remediation research in terms of publication year, research objectives, research approaches, and research subjects, 2) Physics concepts that were given remediation treatment, and 3) the effectiveness of Physics misconception remediation efforts in reducing misconceptions. The research method employed was a Systematic Literature Review (SLR) of the literature from 2019 to early 2025, conducted across the Scopus, ERIC, and Google Scholar databases. The results showed that the trend of misconception remediation research was primarily conducted in 2023, with a focus on high school students. The order of Physics misconception remediation efforts from the most widely applied consecutively is by applying learning media (interactive media, worksheet, and e-module), learning models (CCM, inquiry, SSCS, synectis model), learning methods (narrative feedback, refutation text), learning strategies (cognitive conflict and generative), and learning approaches (multiple representation). These results can contribute to improving the quality of Physics learning, especially by providing educators and researchers with a variety of options to design interventions that correct Physics misconceptions.

Keywords: Misconception, Physics, Remediation

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INTRODUCTION

Students in the learning process interpret a concept personally as a conception (Royani & Setyarsih, 2022; Suyono et al., 2023). Each student's conception can vary due to differences in thinking abilities. Scientific conceptions that are not fully developed can lead to misconceptions. Misconceptions are defined as meanings and hierarchical relationships between concepts that are not constructed correctly (Maknun & Marwiah, 2022) and are based on strong self-belief (Gurel et al., 2017; Sundaygara et al., 2021). Misconceptions are also referred to as alternative concepts and

misunderstandings of concepts (Astuti et al., 2023). Misconceptions indicate the low understanding of students in learning topics, especially in Physics. Various Physics misconceptions have been revealed in various studies (Dewi & Wulandari, 2021; Gumilar, 2016; Nasution et al., 2021; Ndruru et al., 2024; Rusli et al., 2016; Silung et al., 2016; Taqwa et al., 2020; Wiyono et al., 2016). Physics is a topic prone to misconceptions because it encompasses many abstract concepts that can only be understood with the aid of media, simulations, and proof processes (Sani et al., 2025; Sudiarmika & Subagia, 2022; Suhendi & Ardiansyah, 2021). Misconceptions are a serious problem in learning because they lead to a chain of misconceptions in related materials (Juita et al., 2023; Triyani et al., 2019). Misconceptions in Physics learning can cause students to be lazy to learn (Resbiantoro, 2022), lag behind in classroom learning (Rokhim et al., 2023), have decreased learning outcomes (Maharani et al., 2019), and experience decreased retention (Díaz et al., 2020; Putri et al., 2021).

Misconceptions are caused by a variety of factors that generally come from wrong intuitions. (Astuti et al., 2023; Winarni et al., 2024); preconceptions, learning resources, context, and teacher (Kismiati & Hutasoit, 2024; Maharani et al., 2019; Maknun & Marwiah, 2022; Rahmadani et al., 2023; Suhendi & Ardiansyah, 2021). The results showed that the teacher was one of the contributors to misconceptions by ignoring students' alternative concepts and not connecting the material with its usefulness in real life (Redhana et al., 2017), unclear delivery of information (Redhana et al., 2018) and ignore meaningful learning (Margunayasa et al., 2021).

One of the characteristics of misconceptions is that they are long-lasting and difficult to change. (Díaz et al., 2020; Parwati & Suharta, 2020; Putri et al., 2021; Sudiarmika & Subagia, 2022). People with misconceptions strongly believe that their conceptions are correct (Ibrahim & Sunanto, 2022). Due to the retention characteristics of misconceptions, it is important to eliminate them through remediation as soon as possible to prevent them from progressing to the next level of education. Misconception remediation requires good strategies and tools because conventional learning steps are not suitable for it (Mimanah et al., 2020). Misconceptions in physics pose significant risks to learning, so a deep understanding of physics misconception remediation efforts is necessary. To accommodate this purpose, a review of physics misconception remediation efforts is necessary. Therefore, a review of Physics misconception remediation is important. Reviews on Physics misconception remediation have previously been conducted, but in limited numbers, including by Resbiantoro et al. (2022) which reviewed the profile, causes, and remediation of Physics misconceptions and Pebriani et al. (2024) who reviewed the remediation of misconceptions related to impulse and momentum. Based on this data, this research is important for enriching physics misconception remediation options that can be tailored to the characteristics and needs.

The novelty of this research lies in the application of a systematic method, as outlined in a systematic literature review, to analyze physics misconception remediation efforts in terms of research trends in misconception remediation, remediated Physics topics, and the effectiveness of each Physics misconception remediation effort. The difference between this study and previous similar studies is that this study presents a review from various perspectives that were not examined in previous studies, such as trends in the types and objectives of research on the remediation of misconceptions in physics, as well as data on the effectiveness of each treatment in remedying misconceptions in physics. The parameters of this study are crucial for providing researchers with information to inform their studies on misconception remediation, serving as a basis for considering specific interventions tailored to their research objectives.

This research is based on the importance of Physics misconception remediation to support the improvement of learning quality that is free from misconceptions. The results of this review contribute to the field of Physics education, especially in overcoming Physics misconceptions. Finally, this review provides information about curative efforts to overcome Physics misconceptions with the characteristics of each unique effort. Based on the explanation that has been presented, this article aims to describe: 1) the trend of Physics misconception remediation research from 2019-2024 (and some early 2025 if relevant) in terms of publication year, research objectives, research approaches, and research subjects, 2) Physics concepts that were given remediation treatment, 3) the effectiveness of Physics misconception remediation efforts in reducing misconceptions.

RESEARCH METHOD

This research employs a systematic literature review (SLR) method. SLR is a systematic step in collecting, evaluating, and describing the findings of various research results tailored to the problems that have been focused on (Pati, 2018). The SLR method facilitates the collection of relevant data to answer the research questions that have been formulated (Mengist, 2019). The research steps are shown in Figure 1.

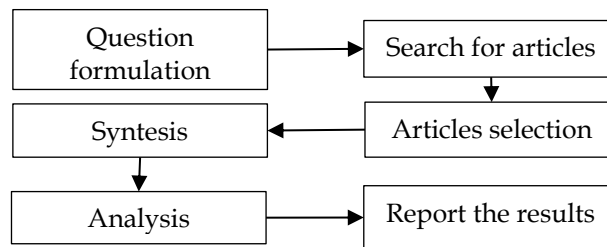


Figure 1. The research procedure

Question formulation

At this stage, the research problem was formulated in accordance with the research topic. The formulation of the research problem is as follows.

RQ1. What is the trend of Physics misconception remediation research from 2019 to early 2025 in terms of publication year?

RQ2. What is the trend of Physics misconception remediation research in 2019 to early 2025 in terms of research objectives?

RQ3. What is the trend of Physics misconception remediation research in 2019 to early 2025 in terms of research approach?

RQ4. What is the trend of Physics misconception remediation research in 2019 to early 2025 in terms of research subjects?

RQ5. What are the Physics topics that receive misconception remediation treatment?

RQ6. What is the effectiveness of each remediation effort in reducing and eliminating Physics misconceptions?

Search for articles

The article search in this study was conducted using the Publish or Perish application on the Scopus, ERIC, and Google Scholar databases. The inclusion and exclusion criteria for eligible articles are shown in Table 1.

Table 1. Article inclusion and exclusion criteria

Aspect	Criteria
Inclusion criteria	Articles according to research topics regarding Physics misconception remediation The publication year was from 2019 to early 2025 Articles were indexed by Scopus or Sinta 1, Sinta 2, or Sinta 3 Full text and open access articles The article is only in the form of a journal article Articles must be written in English
Exclusion criteria	Articles outside the research topic Publication before 2019 Articles do not meet journal indexing criteria Unfull text and closed-access articles Articles not in the form of journal articles Articles not written in English

Articles Selection

This stage is the search and selection stage of the research articles to be reviewed. The keywords applied in the Publish or Perish search engine are “misconception remediation” and “misconception reduction”. The article selection process is shown in Figure 2.

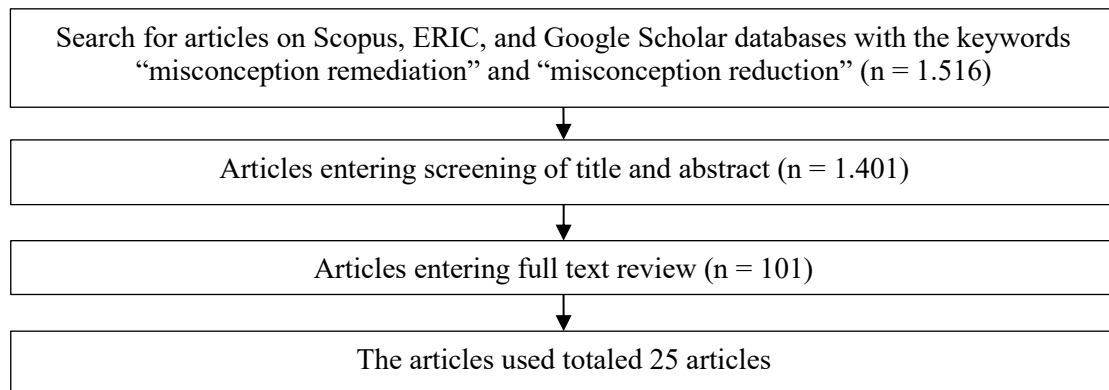


Figure 2. Article selection process

The article selection stage yielded 25 articles from reputable international and national journals published between 2019 and early 2025. The list of journals, numbers, and indices of the eligible articles is shown in Table 2.

Table 2. Number of articles from research journals that met the eligibility criteria

Journal	Amount	Indexed by
Jurnal Penelitian dan Pengembangan Pendidikan Fisika	1	Sinta (S2)
International Journal of Recent Educational Research	1	Sinta (S2)
Journal of Science Learning	1	Sinta (S2)
Jurnal Pendidikan Sains Indonesia (Indonesian Journal of Science Education)	1	Sinta (S2)
Jurnal Inovasi Pendidikan IPA	1	Sinta (S2)
Jurnal Penelitian Pendidikan IPA	10	Sinta (S2)
Education sciences	1	Scopus (Q1)
Contemporary Educational Psychology	1	Scopus (Q1)
Journal of Turkish Science Education	3	Scopus (Q2)
Quality Assurance in Education	1	Scopus (Q2)
Journal of Technical Education and Training	1	Scopus (Q3)
Participatory Educational Research (PER)	1	Scopus (Q3)
Jurnal Pendidikan IPA Indonesia	2	Scopus (Q3)

Quality assessment

Each data point in this study is evaluated using several criteria based on quality assessment (QA) questions. Each journal article will be given an answer value of “Yes” or “No”.

QA1. Does the research article clearly state the research problem and objectives?

QA2. Does the research article accommodate the metadata required for synthesizing and analyzing the research results?

Synthesis, Analysis, and Report

The synthesis stage involves extracting data from each research article to generate a discussion. The synthesized data is then presented informatively. Following this, the analysis is conducted by addressing the research questions. The result of this stage is a discussion in the form of a narrative that leads to a conclusion. The final process is to report the research results in the form of a scientific article.

RESULTS AND DISCUSSION

Based on the synthesis and analysis of 25 research articles, it was found that each Physics misconception remediation research study exhibited various trends. The results of this review refer to the synthesis results based on the year of publication, research objectives, research approaches, research subjects, Physics topics remediated, and the effectiveness of each remediation technique on misconception reduction. Trends in physics misconception remediation research based on year of publication are presented in Figure 3.

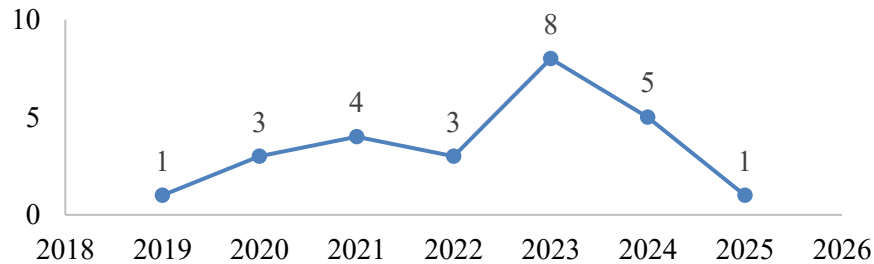


Figure 3. Trends in the number of physics misconception remediation studies from 2019 to early 2025

Figure 3 explains the trend in the number of publications of articles with the theme of Physics misconception remediation from 2019 to early 2025. Based on the synthesis results, from 2019 to 2021, the number of Physics misconception remediation articles has increased, then decreased in 2022. After 2022, there was a significant increase in the number of publications in 2023. This is particularly relevant in the context of 2023, which follows the COVID-19 pandemic. Efforts to restore the learning situation include addressing misconceptions resulting from learning limitations during the pandemic. This is in line with the results of Dewi & Wulandari, (2021); Munastiwi et al., (2022) that Physics misconceptions have increased during the Covid-19 pandemic due to limited media, reduced learning activities, and suboptimal experiments. After 2023, the number of publications on Physics misconception remediation has decreased significantly; until early 2025, only one full-access research paper was found. This opens up hope that the results of this study can serve as an introductory database for initiating research on Physics misconception remediation in accordance with the development of educational dynamics.

Trend of Physics misconception remediation research based on research objectives

Based on the 25 research articles synthesized, it was found that research on Physics misconception remediation efforts had been conducted with two groups of research objectives. A summary of the research objectives is shown in Table 3.

Research aim	Percentage (%)
Exploring the effectiveness of remediation efforts on misconception reduction	84
Develop and validate a product to remediate misconceptions	16

Based on the synthesis results, 21 articles (84%) aim to determine the effectiveness and influence of applying misconception remediation efforts on reducing physics misconceptions. On the other hand, there are 4 articles (16%) that aim to develop and validate products to remediate misconceptions, i.e. Afriwardani et al., (2023); Mimanah et al., (2020); Mufida et al., (2023); Rafika et al., (2023). Based on this data, it can be said that the majority of Physics misconception remediation research aims to test the effectiveness of an effort in reducing Physics misconceptions.

Trend of Physics misconception remediation research based on the research approach

The synthesis results, when viewed in light of the research approach, are grouped into quantitative, mixed-method, and Research and Development (R&D) categories. The trend of misconception remediation research based on the research approach is shown in Table 4.

Table 4. Trends in research approaches to remediating physics misconceptions

Research approach	Frequency
Quantitative	20
Mixed method	1
R&D	4
Amount	25

Based on Table 4, the most widely used research approach in Physics misconception remediation research is the quantitative approach as many with 20 articles (80%), the second most used approach is R&D as many with 4 articles (16%), and the least used research approach is mixed method as many with 1 article (4%). Based on this data, it can be observed that quantitative approaches, with a focus on pre-experimental and quasi-experimental research methods, predominantly characterize research aimed at remedying physics misconceptions. The most prevalent research design is the one-group pretest-posttest design. On the other hand, the R&D approach uses 4D and ADDIE development models.

Trend of Physics misconception remediation research based on the remediation subject

The results of the synthesis, when reviewed in relation to the research subject, encompassed diverse research participants from elementary school students, junior high school students, high school students, vocational high school students, university students, and teachers. A summary of the review results based on the research subject is shown in Figure 4.

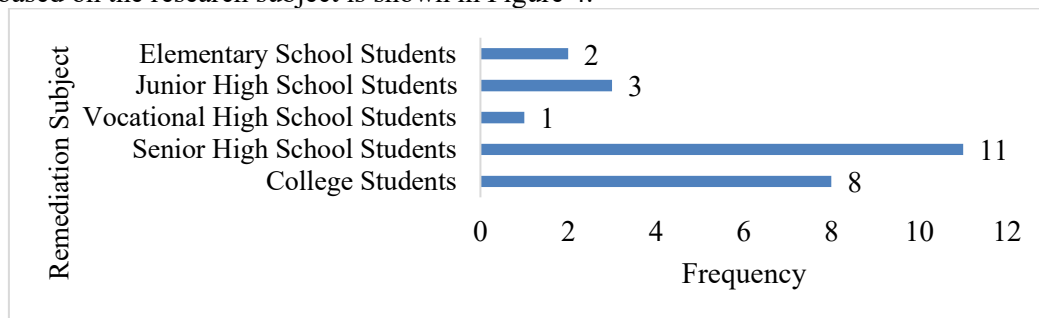


Figure 4. Trend of research subjects for physics misconception remediation

Figure 4 illustrates the subjects who received treatment for misconception remediation, ranging from elementary school education to university students, specifically prospective teachers. These results prove that misconceptions can occur to everyone without exception (Haryono et al., 2024; Ogundare et al., 2024). Remediation of misconceptions in elementary school subjects is carried out with a scaffolding-integrated inquiry learning model (Haidar et al., 2020) and flashcard-assisted inquiry learning media (Mimanah et al., 2020). The remediation of misconceptions in junior high school subjects was conducted with the SSCS learning model (Taqwim et al., 2022), dry lab-based augmented reality (Akhsan et al., 2023), and comic-based e-modules (Mukramah et al., 2023). Remediation of misconceptions in vocational high school subjects using the conceptual change model based on virtual simulation media (Maknun & Marwiah, 2022).

Misconception remediation in senior high school subjects conducted with interactive e-books (Afriwardani et al., 2023), refutation text with 3-2-1 reading strategy (Djudin, 2021), generative learning strategy (Pardiyanto & Winarti, 2021), ISLE-based worksheet (Rafika et al., 2023), conceptual change model based on PDEODE*E task (Samsudin et al., 2024), concept cartoon-based worksheet (Siong et al., 2023), interactive media based on VBA Excell Spreadsheet (Zulfira et al., 2024), computer simulation on refutation text (CoSiReT) (Mufida et al., 2023), e-learning based collaborative learning (Haryono et al., 2024; Haryono et al., 2024), and synectics learning model assisted by mind mapping (Sani et al., 2025). Remediation of misconceptions in college student subjects and prospective teachers is carried out with the conceptual change model (CCM) (Makhrus et al., 2023), multiple representative approach (Busyairi et al., 2021), Hybrid learning-based CCM (Hermita et al., 2024), refutation text (Weingartner & Masnick, 2019), animated concept cartoon (Ozdemir, 2022), cognitive conflict based learning (Mufit et al., 2023), narrative feedback (Halim et al., 2023).

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al., 2021), and e-modules based on PhET simulation media (Halim et al., 2020). Based on this data, it can be said that remediation of misconceptions is needed from the lowest level of education, namely, elementary school, even for prospective teachers. This confirms that misconceptions can last a long time and be carried over to the next level of education (Haidar et al., 2020; Juita et al., 2023; Nasrudin & Azizah, 2020; Triyani et al., 2019).

Physics topics that received misconception remediation treatment

Based on the synthesis, the most analyzed and remediated Physics topics are the concept of heat, Newton's law, and static fluid. The many abstract concepts in Physics support the high number of misconceptions in various Physics topics (Sani et al., 2025; Sudiatmika & Subagia, 2022; Suhendi & Ardiansyah, 2021). The Physics topics analyzed are shown in Table 5.

Table 5. Physics topics that were given misconception remediation treatment

Physics Topics	Frequency	Authors
Simple harmonic motion	1	Afriwardani et al. (2023)
Solar system	1	Akhsan et al. (2023)
Straight motion	1	Busyairi et al. (2021)
Buoyancy concept	1	Djudin (2021)
Light concept	2	Haidar et al. (2020), Mimanah et al. (2020)
Modern Physics concept	1	Halim et al. (2020)
Free-fall motion	1	Halim et al. (2021)
Heat concept	3	Haryono et al. (2024), Haryono et al. (2024), Hermita et al. (2024)
Vibration and waves	1	Makhrus et al. (2023)
Transverse waves	1	Mufida et al. (2023)
Static fluid concept	3	Maknun and Marwiah (2022), Mufit et al. (2023), Sani et al. (2025)
Newton's law concept	3	Mukramah et al. (2023), Pardiyanto and Winarti (2021), Weingartner and Masnick (2019)
Centrifugal force	1	Ozdemir (2022)
Parabola motion	1	Rafika et al. (2023)
Force concept	1	Samsudin et al. (2024)
Electricity concept	1	Mukramah et al. (2023)
Work and energy	1	Taqwim et al. (2022)
Traveling wave	1	Zulfira et al. (2024)

The effectiveness of each misconception remediation effort in reducing Physics misconceptions.

Table 6. Summary of research results on the theme of Physics misconception remediation

Author's	Findings	Category of Effectiveness
Afriwardani et al. (2023)	The results showed that the interactive Physics e-book was effective in reducing the percentage of misconceptions by 11.00% and the effectiveness of the E-book in increasing students' scores was in the medium criteria. The practicality of the E-book is in the very good category ($\Delta M = 11\%$)	Low
Akhsan et al. (2023)	The results showed that the effectiveness of augmented reality-based dry lab in remediating students' misconceptions was 45.16% ($\Delta M = 45.16\%$)	Moderate
Busyairi et al. (2021)	The results showed that the multi-representative approach based on e-modules was able to reduce the percentage of misconceptions from 57.19% to 25.30% and there was an increase in concept understanding from 18.14% to 72.38% ($\Delta M = 55.76\%$)	Moderate

Djudin (2021)	The results showed that the application of the 3-2-1 reading strategy, integrated with refutation text, can significantly reduce misconceptions by 54.71%, and there is a significant change in concept understanding among students. ($\Delta M = 54.71\%$)	Moderate
Haidar et al. (2020)	The results showed that the scaffolding-based inquiry learning model, both orally and in writing, can reduce the average percentage of misconceptions from 38.7% to 15.4%. There were 11 out of 13 concept indicators that experienced a decrease in the percentage of misconceptions, and 2 concept indicators were perfectly remediated; there were no concept indicators that experienced an increase in the percentage of misconceptions. ($\Delta M = 60.20\%$)	Moderate
Halim et al. (2020)	The results of the study based on the difference in misconception N-gain for each question item show that the e-learning module can remediate the level of misconception, but not for all concepts. E-learning modules can only remediate abstract and specific concepts and do not require mathematical calculations.	-
Halim et al. (2021)	The results showed that the most effective treatments in reducing misconceptions were narrative feedback, with an N-gain score of 0.54, realistic video, with an N-gain score of 0.33, and an e-learning module, with an N-gain score of 0.25. The three treatments have different effects on reducing misconceptions.	-
Haryono et al. (2024)	The results showed that E-learning-based collaborative learning can reduce the average percentage of students' misconceptions from 94.67% to 39.33% ($\Delta M = 58.45\%$).	Moderate
Haryono et al. (2024)	The results showed that the application of collaborative learning-based e-learning can reduce the percentage of misconceptions by 26.5% ($\Delta M = 26.5\%$, low category).	Low
Hermita et al. (2024)	The results showed that hybrid learning is the most effective method to remediate misconceptions. Hybrid learning can reduce 90.32% of misconceptions, blended learning can reduce 63.33% of misconceptions, and face-to-face learning can reduce 62.50% of misconceptions.	Moderate to high
Mimanah et al. (2020)	The results showed that the application of inquiry learning media assisted by flashcard media was effective in reducing misconceptions from 57.33% to 17.33% with valid, practical, and effective criteria ($\Delta M = 70.00\%$).	High
Makhrus et al. (2023)	The results showed that CMM CCA can reduce the average number of students who experience misconceptions from 17.80 to 5.30 ($\Delta M = 70.22\%$).	High
Maknun & Marwiah (2022)	The results showed that the CCM model, assisted by PhET virtual simulation media, can reduce misconceptions with an average score of 0.79 (in the high category).	High
Mufida et al. (2023)	The results showed that the CoSiReT application was able to reduce students' misconceptions by 80.75% ($\Delta M = 80.75\%$).	High

Mufit et al. (2023)	The results showed that the CCBL model was effective in reducing misconceptions by 16.5%.	Low
Mukramah et al. (2023)	The results showed that comic-based e-modules assisted by flipbooks can reduce the percentage of misconceptions from 57.01% to 20.24%.	Moderate
Ozdemir (2022)	The results showed that 29.10% of students who experienced misconceptions also experienced cognitive conflict during the implementation of the animated concept cartoon. This shows that animated concept cartoons can be used to initiate cognitive conflict as the first step of misconception remediation ($\Delta M = 15.80\%$).	Low
Pardiyanto & Winarti (2021)	The results showed that the implementation of generative learning strategies, assisted by flash animation, was effective in reducing misconceptions, with an average percentage of 20.00%.	Low
Rafika et al. (2023)	The results showed that the ISLE-based worksheet, assisted by PhET animation, was effective in reducing misconceptions from 42.22% to 12.78% ($\Delta M = 29.44\%$).	Moderate
Samsudin et al. (2024)	The results showed that a reconstruction of conception occurred after the implementation of CCM with the PDEOD*E task, with an average percentage of concept change of 34.50%.	Moderate
Sani et al. (2025)	hasil penelitian menunjukkan aplikasi synectics model berbantuan mind mapping dapat mereduksi miskonsepsi dengan N-gain ternormalisasi sebesar 0.63.	Moderate
Siong et al. (2023)	The results showed that the implementation of concept cartoons can detect and correct misconceptions, with an average score of 3.87 before treatment and 7.60 after treatment, indicating a significant increase (N-Gain) of +3.73.	-
Taqwim et al. (2022)	The results showed that the SSCS model can significantly reduce the average percentage of misconceptions from 27.42% to 16.43% ($\Delta M = 40.08\%$).	Moderate
Weingartner & Masnick (2019)	The results showed that knowledge revision occurred through refutation text. A total of 96.15% of respondents experienced knowledge revision in the explanation-refutation condition type text, 83.33% in the Explanation-Warning condition type text, and 55.56% in the Explanation-Only condition type text. This indicates that refutation text can initiate concept revision ($\Delta M = 78.34\%$).	High
Zulfira et al. (2024)	The results showed that interactive learning media based on VBA (Visual Basic for Application) Excel spreadsheet was effective in reducing the percentage of misconceptions from 28.50% to 11.40% ($\Delta M = 60.00\%$).	Moderate

Based on the synthesis results, the order of Physics misconception remediation efforts from the most widely applied is successively with the application of learning media as much as 10 studies (40%), learning models as much as 7 studies (28%), learning methods as much as 4 studies (16%),

learning strategies as much as 3 studies (12%), and learning approaches as much as 1 study (4%). All methods/techniques of misconception remediation show varying results and effectiveness in reducing misconceptions into scientific conceptions. This effectiveness is evident from the decrease in the average percentage of misconceptions and n-gain after treatment (posttest). Based on Hake (1998) in Hermita et al. (2024) that a remediation effort is classified as having high effectiveness if the remediation percentage $\Delta M \geq 70\%$, moderate effectiveness if the remediation percentage is $30\% \leq \Delta M \leq 69\%$, and low effectiveness if the remediation percentage $\Delta M < 30\%$.

Remediation efforts with a high effectiveness category based on the percentage of misconception reduction and n-gain score are CCM-hybrid learning, Computer simulation on refutation text (CoSiReT) conceptual change model, refutation text, CCM-Cognitive Conflict Approach, and inquiry-based science learning material using flashcards. Remediation efforts with moderate effectiveness categories such as ISLE-based learning media using PhET simulation, comic-based e-module assisted by the flipbook maker (64.5%), CCM-blended learning, CCM-face-to-face learning, inquiry learning with scaffolding, interactive learning media using Visual Basic for application Excel spreadsheet, E-learning based collaborative learning, multiple representative approach, refutation text integrated with 3-2-1 reading strategy, dry lab-based augmented reality, SSCS model, conceptual change model (CCM) with PDEODE*E tasks, narrative feedback, dan realistic video, Synectics model assisted mind mapping. Remediation efforts with a low effectiveness category include an interactive Physics e-book, collaborative learning-based e-learning, the CCBL model, animated concept cartoons, and generative learning strategies assisted by flash animation.

Based on the synthesis results, the majority of efforts to remediate misconceptions involve applying the Conceptual Change Model (CCM) and presenting cognitive conflict situations. The Conceptual Change Model is a learning model that directs the interaction between erroneous conceptions and scientific concepts (Redhana et al., 2017). The success of CCM in reducing misconceptions is due to the cognitive imbalance between prior knowledge and correct scientific concepts. CCM is based on conflicting phenomena and ends in proof activities in proving the truth of a concept (Makhrus et al., 2023). CCM leads to a situation of cognitive conflict. This cognitive conflict creates a cognitive confrontation between the initial conception and the new scientific concept (Maknun & Marwiah, 2022; Posner et al., 1982). Cognitive conflict directs learners to be aware of the misconceptions experienced, so that the correct scientific concept can be finally built (Mufit et al., 2023). It is explained that there are four conditions for changing conceptions, namely, the old conception must be felt unsatisfactory by students, the replacement conception must be understandable, reasonable, and useful for students (Posner et al., 1982). Misconceptions experienced by students can only be overcome if they know that the concept that has been believed to be true is actually wrong (Novita et al., 2024).

Misconception remediation efforts cannot eliminate all misconceptions on their own. Based on the synthesis results, there are no misconceptions that can be remediated to reduce the overall misconceptions. This is in line with the research results Halim et al. (2020) The treatment applied can remediate misconceptions, but it cannot remediate all concepts, especially concepts that involve mathematical calculations. The biggest obstacle encountered in the effort to remediate misconceptions is the retention of misconceptions (Ogundare et al., 2024; Sudiatmika & Subagia, 2022). Retention of misconceptions occurs due to a condition of imbalance caused by cognitive conflict that does not reach the phase of complete balance (Islamiyah et al., 2022). These resistant misconceptions will persist for a long time and hinder the remediation process (Ibrahim & Sunanto, 2022; Putri et al., 2021).

Ultimately, all remediation efforts have their own distinct characteristics, yet they share the common goal of eliminating misconceptions. Remediation efforts will be effective if there is a process of cognitive imbalance between misconceptions and scientific concepts, accompanied by the realization that the concepts believed to be true are wrong. This is in accordance with Haryono et al. (2021) and Islamiyah et al. (2022), who state that cognitive conflict is an essential condition for changes in conception, so that reconstruction of understanding of scientific concepts can be achieved.

CONCLUSION

Misconceptions are cognitive disorders that hinder the scientific and meaningful learning process. Misconceptions are long-lasting and difficult to change, so remediation of misconceptions is the most appropriate countermeasure. Based on the review results, the trend of misconception remediation research was primarily carried out in 2023 at the senior high school education level. The majority of Physics misconception remediation research is carried out using a quantitative approach that aims to test the effectiveness of misconception remediation efforts in terms of misconception reduction. The order of Physics misconception remediation efforts from the most widely applied consecutively is with learning media (worksheets, e-books, interactive media, e-modules, e-learning, and virtual simulation), learning models (CCM, inquiry, SSCS, synectics model), learning methods (narrative feedback, refutation text), learning strategies (cognitive conflict and generative), and learning approaches (multiple representation). All of these remediation efforts can be integrated to design appropriate and effective misconception remediation efforts tailored to the characteristics and needs. Misconception remediation can be successful only if the subject successfully experiences and passes the cognitive conflict stage, accompanied by the realization that they believe the truth of the wrong concept. None of the studies analyzed mentioned the limitations of the remediation strategies for misconceptions in Physics that were applied. Therefore, this study suggests that researchers should further explore the limitations of the strategies used to remediate specific misconceptions, enabling more effective application. Future research can be recommended to identify the advantages and disadvantages of each Physics misconception remediation effort, including challenges and obstacles in implementing a Physics misconception remediation

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