

An Analysis of The Application of The Arcs Model in Physics Learning: A Systematic Review of Studies from 2016-2024

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Article Info	Abstract
Article history: Received: July 31, 2025 Accepted: October 17, 2025 Published: November 5, 2025 Keywords: ARCS model Motivational design Physics learning Systematic literature review This article is licensed under a creative commons attribution-share alike 4.0 international license © 2025 Jurnal ilmiah Pendidikan Fisika	This study investigates the development, implementation, and impact of the Attention, Relevance, Confidence, Satisfaction (ARCS) model in physics education. A Systematic Literature Review (SLR) using the PRISMA approach was conducted by analyzing relevant studies published between 2016 and 2024. From an initial search of 687 articles, 9 studies indexed in SINTA and Scopus met the inclusion criteria and were analyzed. This study found that research on the ARCS model in physics education shows a consistent publication trend, dominated by studies at the high school level and focused on basic physics topics such as kinematics, heat, and magnetism. The ARCS model was applied both independently and in combination with modern approaches, including flipped classrooms, e-learning, and mobile learning. The findings indicate that the ARCS model effectively enhances student motivation, learning outcomes, and conceptual understanding, demonstrating its strong pedagogical adaptability across learning contexts. However, most studies emphasize general motivation rather than higher-order outcomes. This study concludes that the ARCS model has significant potential as a flexible motivational framework in physics education, highlighting the need for future research on its effectiveness in promoting critical thinking, creativity, and concept mastery in more complex physics topics.
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INTRODUCTION

The ARCS model (Attention, Relevance, Confidence, Satisfaction) is one of the learning design models that focuses on increasing student motivation. This model was developed by [Keller \(2009\)](#), who motivates students' learning by capturing their attention, selecting materials relevant to their needs, fostering confidence, and encouraging satisfaction with their learning achievements. The integration of the ARCS model into learning generally has a positive impact on students' motivation and academic performance, making it widely applied in educational settings to create more effective learning experiences ([Goksu & Islam Bolat, 2021](#); [Li & Keller, 2018](#)).

Several studies have investigated the application of the ARCS model in educational contexts, confirming its overall effectiveness. For instance, [Montero \(2020\)](#) demonstrated a significant increase in academic achievement by applying ARCS in tenth-grade physics

learning. Similarly, [Zahra & Subekti \(2025\)](#) and [Wulan \(2023\)](#) confirmed its effectiveness in enhancing motivation and cognitive abilities, including those related to Newton's Laws material. The integration of ARCS with modern learning models such as the flipped classroom ([Aşıksoy & Özdamli, 2016](#); [Bhakti et al., 2021](#)), *e-learning* ([Setyowati et al., 2022](#); [Sukmawati et al., 2022](#)), and mobile *learning* ([Arredondo & Riquelme, 2022](#)) further expanded its application potential. However, despite this consistent evidence of ARCS's success, a significant research gap remains. Most existing studies suffer from limitations, including a narrow focus on general motivational aspects, small sample sizes, and a concentration on basic physics topics (such as thermodynamics, electromagnetism, or wave phenomena). Crucially, there is a lack of rigorous, large-scale studies exploring the ARCS model's impact on complex learning outcomes in physics, such as critical thinking skills, high-level conceptual mastery, and its application across diverse educational levels or in conjunction with the latest innovative learning models.

Studies related to the application of ARCS are generally scattered across various educational disciplines and lack a focused synthesis specifically within the context of physics learning, which has its own characteristics and requires an appropriate motivational approach to build student interest and engagement optimally ([Nawahdani et al., 2022](#); [Wahyuni & Nadia, 2024](#)). This fragmented landscape and the identified gap regarding complex outcomes underscore the need for a comprehensive literature review to map the development of research, implementation strategies, and the specific impact of ARCS in physics education. The novelty of this study lies in its focus on the physics context, the use of the SLR method with strict selection criteria (articles indexed in SINTA and Scopus), and the identification of specific thematic and methodological gaps for future research agendas.

Therefore, a comprehensive literature review is needed to obtain a more complete picture of the implementation of the ARCS model in physics learning. This study aims to provide a comprehensive overview of the development of research on the ARCS model in physics education from 2016 to 2024, to describe how the model has been applied in various learning contexts, and to analyze its effects on student motivation and learning outcomes.

METHODS

This research employed a Systematic Literature Review (SLR) approach following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines ([Tricco et al., 2018](#)) (See Figure 1). The process involved systematically identifying, evaluating, and synthesizing relevant studies on the application of the ARCS model in physics learning. Articles were obtained using Publish or Perish (PoP) software with the keyword “ARCS,” and data were sourced exclusively from the SINTA and Scopus databases. This restriction ensured high methodological rigor and academic quality, as both databases include peer-reviewed journals with transparent indexing standards. The publication period 2016–2024 was selected to capture contemporary trends, particularly the increasing integration of motivational design with digital and student-centered learning approaches in STEM education.

The initial search identified 687 articles. The screening process was conducted in multiple stages with inclusion criteria: (1) empirical research; (2) focused on the implementation of the ARCS model in physics learning; and (3) full-text availability and contextual relevance. Non-empirical or non-physics-related studies were excluded. After screening, 16 articles remained, which were further assessed for methodological quality and data completeness. The quality assessment used a checklist adapted from established SLR protocols, evaluating research design validity, data analysis clarity, and the precision

of ARCS implementation reporting. Only nine articles met all the inclusion and quality criteria. The small final number reflects the stringent selection requirements, emphasizing physics-specific studies published in reputable SINTA (1–4) or Scopus (Q1–Q4) journals with adequate methodological transparency.

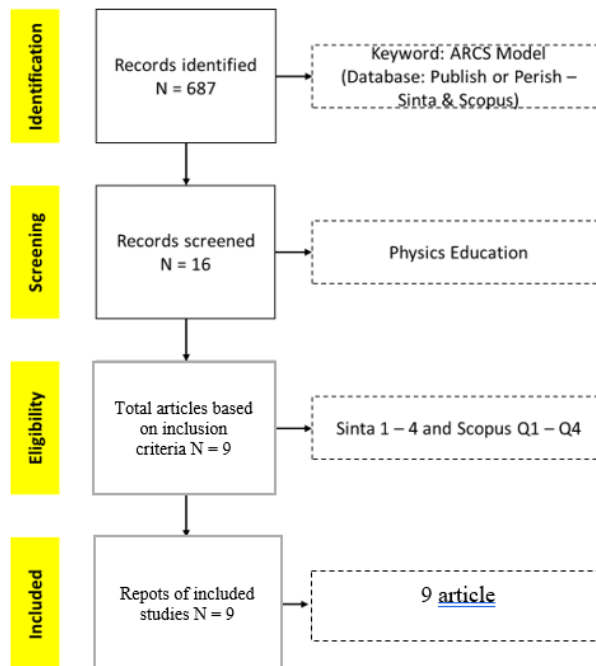


Figure 1 Research stages

Data extraction was conducted using Mendeley for reference management and Microsoft Excel for data coding and synthesis. Extracted indicators included (1) publication year, (2) education level, (3) physics topic, (4) implementation strategy, and (5) research outcomes (motivation, learning achievement, and conceptual understanding). Qualitative thematic grouping was supported using NVivo to identify patterns and dominant themes across studies. The overall research process followed a systematic flow based on the PRISMA model adapted for the research (Riska et al., 2025), as shown in Figure 1.

RESULTS AND DISCUSSION

An analysis of 9 selected articles reveals various approaches to applying the ARCS model in physics education. Each article shows variations in context, educational level, integration strategies, and the impact of applying the ARCS model. The results of the analysis are summarized in Table 1.

Table 1. List of Articles on the Application of the ARCS Model in Physics Learning

No.	Authors	Description
1	Aşıksoy & Özdamlı (2016)	The Flipped Classroom Approach, an adaptation of the ARCS motivation model applied to physics courses, significantly improves student learning achievement, motivation, and self-confidence compared to traditional methods.
2	Thaer & Thaer (2016)	Comparing the ARCS motivation model and traditional methods in teaching physics magnetism units to tenth-grade students.
3	Fitriah (2018)	Application of the ARCS motivation strategy in the Basic Physics 1 lecture for undergraduate students in the Department of Physics Education at UIN Antasari Banjarmasin.

No.	Authors	Description
4	Yulianti et al. (2019)	The ARCS learning model was applied to heat-related material for 10th-grade students at Singkawang 6 Public High School to measure learning motivation and learning outcomes.
5	Afjar et al., (2020)	Determining the effect of the ARCS learning model on the motivation and learning outcomes of 11th-grade high school students in physics learning on optical equipment material.
6	Bhakti et al. (2021)	The implementation of the ARCS model in junior high school physics teacher training, which utilizes a flipped classroom learning approach, aims to enhance teachers' abilities, motivation, and interest.
7	Sukmawati et al., (2022)	Determining the level of high school students' motivation in learning physics during the COVID-19 pandemic through e-learning platforms, both in general and based on gender, and analyzing the contribution of ARCS aspects.
8	Setyowati et al. (2022)	Analyzing the learning motivation of 11th-grade science students in Samarinda in e-learning-based physics learning using the ARCS model.
9	Arredondo & Riquelme, (2022)	Evaluation of the impact of implementing m-learning tailored to the ARCS Motivation Model on the motivational and learning outcomes of college students studying kinematics.

Publication Trends and Characteristics of ARCS Model Research in Physics Learning

The trend of publications indicates that research on the application of the ARCS model in physics education has been relatively stable between 2017 and 2021, with only one article published each year. However, a notable increase occurred in 2022 with three publications, suggesting a growing awareness of the importance of motivational design in physics learning. This increase reflects not only the continuity of interest in ARCS but also its rising relevance as a framework integrated with contemporary learning approaches such as e-learning, flipped classrooms, and mobile learning. Although the overall trend has not shown a consistent upward trajectory, the pattern highlights that the ARCS model is increasingly recognized as a promising strategy for improving physics learning, as shown in Figure 2.

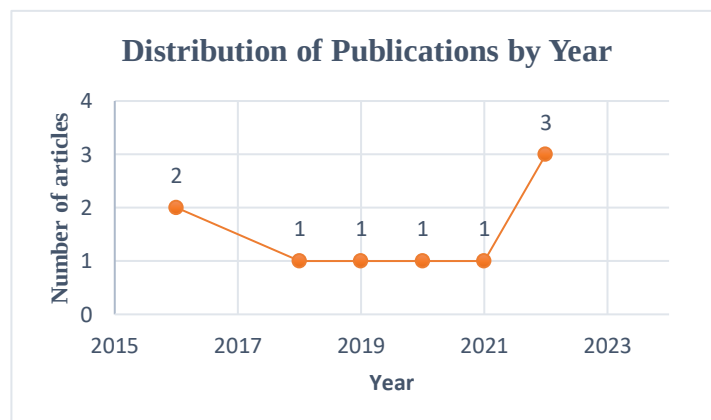


Figure 2 Distribution of publications by year

In terms of characteristics, most of the reviewed studies were conducted at the high school level, indicating that this educational stage is considered critical for applying motivational strategies to strengthen students' interest in physics. A smaller number of studies involved undergraduate students, while one study focused on physics teachers, specifically the research by [Bhakti et al. \(2021\)](#), which showed that ARCS has also been

explored as a framework for professional development. The physics topics most frequently addressed were fundamental concepts such as heat, kinematics, optics, and magnetic fields, suggesting that researchers tend to implement ARCS in core areas where motivation is often a challenge. Moreover, the integration of ARCS with various instructional designs in the flipped classroom ([Aşıksoy & Özdamlı, 2016](#); [Bhakti et al., 2021](#)), e-learning ([Setyowati et al., 2022](#); [Sukmawati et al., 2022](#)), and mobile learning ([Arredondo & Riquelme, 2022](#)) has been explored. Demonstrates its flexibility and adaptability to different teaching contexts. This variety of applications further emphasizes the potential of ARCS as both a standalone motivational strategy and a complementary approach in modern physics education.

The articles reviewed were published in journals with varying index classifications. Two articles appeared in Scopus Q1 journals, one in Scopus Q3, and two in Scopus Q4, while four other articles were published in accredited national journals (two in SINTA 3 and two in SINTA 4). This variation indicates that research on the ARCS model in physics learning has not only been widely disseminated but also recognized in both national and international academic forums. The presence of articles in high-impact journals, such as those indexed in Scopus Q1, demonstrates the growing academic significance of motivational design in physics education, particularly when ARCS is integrated with modern learning innovations like flipped classrooms and mobile learning ([Aşıksoy & Özdamlı, 2016](#); [Arredondo & Riquelme, 2022](#)). Meanwhile, publications in accredited national journals highlight the relevance of ARCS in addressing classroom challenges at the local level, particularly in enhancing student motivation and learning outcomes in core physics topics ([Yulianti et al., 2019](#); [Afjar et al., 2020](#)). These findings suggest that the ARCS model is increasingly acknowledged across different academic communities as both theoretically valuable and practically applicable in physics learning.

The focus of the studies reviewed is generally limited to aspects of improving learning motivation, without exploring the influence of the ARCS model on concept mastery, critical thinking skills, or 21st-century skills in physics learning. [Sukmawati et al. \(2022\)](#) suggest that future research should focus on analyzing student motivation through the ARCS approach in e-learning-based physics learning. [Arredondo & Riquelme \(2022\)](#) also recommend replicating the study by adding a pretest to measure initial motivation levels before implementing ARCS-based learning technology. The implications of these findings suggest the need for a more comprehensive research design to evaluate the effectiveness of the ARCS model not only from a motivational perspective but also in terms of learning outcomes and other cognitive competencies.

ARCS Model Implementation Strategy

The ARCS model is implemented in physics education through various strategies tailored to the context and teaching approach of each study. Most articles do not apply ARCS separately but integrate it with other learning models or media to optimize its motivational impact. For example, the flipped classroom strategy was used in teacher training by [Bhakti et al. \(2021\)](#) and in student learning by [Aşıksoy & Özdamlı \(2016\)](#), both of which combined ARCS to enhance active participation and learning interest through video media and self-directed learning. ARCS-based e-learning approaches are also evident in the studies by [Setyowati et al. \(2022\)](#) and [Sukmawati et al. \(2022\)](#), which aim to maintain student engagement during online learning. Other studies, such as [Afjar et al. \(2020\)](#) and [Yulianti et al. \(2019\)](#), show that the direct application of ARCS without combining other strategies remains effective in improving motivation and physics learning outcomes.

The application of ARCS in the study by [Arredondo & Riquelme \(2022\)](#) was implemented through mobile learning, utilizing the Google Science Journal application.

The ARCS components were designed in digital experiments that allowed students to be actively involved. Attention was built through the introduction of an engaging new application; relevance was achieved by giving students the freedom to choose their experimental objects; confidence was enhanced through clear instructions and opportunities for repetition; and satisfaction was derived from an enjoyable learning experience and feedback based on reports. The model in this study was evaluated using a data collection tool called the Instructional Materials Motivation Survey (IMMS) ([Cook & Skrupky, 2025](#); [Loorbach et al., 2015](#)).

Research by [Fitriah \(2018\)](#) applied the ARCS model in Basic Physics I lectures. The ARCS strategy was implemented through the use of learning media, including colorful PowerPoint presentations and thematic videos, at each meeting. Lecture material was integrated with national values, Islamic character, local Banjar wisdom, and global insights to build student attention. Relevance was established by aligning the material with students' needs and experiences in their daily lives. Confidence was cultivated through the provision of questions appropriate to their abilities and the clear presentation of the material. Satisfaction was provided in the form of stars on attendance sheets for students who successfully answered questions, which then contributed to their assignment grades. Motivation measurement is conducted using the ARCS questionnaire and observation sheets as research instruments. The ARCS questionnaire is adapted from [Jamal \(2009\)](#). The frequency distribution of various ARCS implementation strategies used in the nine articles is summarized in Figure 3.

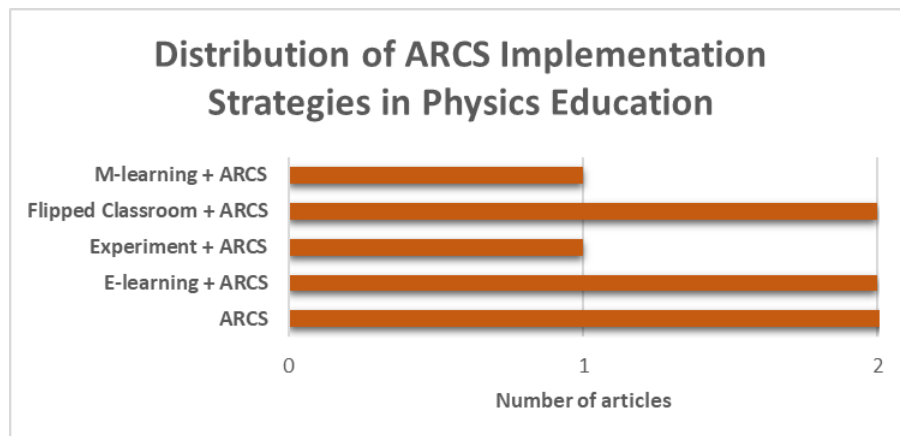


Figure 3 Distribution of ARCS implementation strategies in Physics learning

Based on Figure 3, the distribution shows that ARCS is most frequently applied in combination with flipped classrooms, e-learning, and experimental settings, each with two studies. This indicates that researchers tend to integrate ARCS with interactive and technology-based learning strategies to maximize its motivational impact. Meanwhile, the direct use of ARCS and its integration with mobile learning appear less frequently, suggesting that these approaches are still underexplored. This pattern highlights a research opportunity further to investigate the effectiveness of ARCS in mobile learning and as a standalone model, particularly in diverse physics learning contexts.

The Impact of Applying the ARCS Model on Physics Learning

The use of the ARCS model in physics education has shown positive effects on student motivation and learning outcomes. Studies that use the ARCS model directly without combining it with other methods, such as [Afjar et al. \(2020\)](#) and [Yulianti et al. \(2019\)](#), note

a significant increase in the affective and cognitive aspects of students. In [Afjar et al.'s \(2020\)](#) study, the average learning outcomes score of students in the experimental class was 80.1, with an N-gain of 0.60 (moderate category), higher than that of the control class, which scored 66.5 with an N-gain of 0.36. Meanwhile, students' motivation scores on the satisfaction indicator were the highest (4.74), followed by confidence (4.60), attention (4.55), and relevance (4.50). These results are supported by a systematic review by [Fang et al. \(2024\)](#), which reported that 17 out of 26 studies integrating ARCS into instructional design successfully increased students' learning motivation. Other studies, such as those by [Deublein et al. \(2018\)](#) and [Hao & Lee \(2021\)](#), also demonstrate that the application of ARCS as a guided learning strategy has a significant impact on enhancing motivation and improving learning outcomes.

Several other studies have integrated the ARCS model with more complex learning approaches. ARCS combined with the flipped classroom not only increases learning motivation but also promotes a deeper understanding of physics concepts ([Aşıksoy & Özdamli, 2016](#)). [Bhakti et al. \(2021\)](#) also reported that flipped classroom-based teacher training using the ARCS approach not only strengthens motivation but also improves teachers' ability to design interactive learning. Meanwhile, the study by [Arredondo & Riquelme \(2022\)](#) showed that integrating ARCS into mobile learning helps enhance student engagement and learning experiences through digital experiments based on applications. The positive impact of ARCS is also reflected in the context of online learning. [Setyowati et al. \(2022\)](#) argue that students continue to show moderate to high motivation during ARCS-based e-learning. Even in the emergency situation of the COVID-19 pandemic, as studied by [Sukmawati et al. \(2022\)](#), students continued to show good learning enthusiasm through distance learning designed based on ARCS principles.

Despite the consistent evidence of effectiveness in improving motivation and basic cognitive outcomes, a critical limitation in the reviewed literature is the lack of explicit analysis of higher-order cognitive skills. The focus of the studies reviewed is generally limited to aspects of improving learning motivation, without sufficiently exploring the influence of the ARCS model on critical thinking skills, creativity, or 21st-century skills in physics learning. Furthermore, none of the included studies specifically addressed the long-term sustainability of motivational gains beyond the intervention period. [Sukmawati et al. \(2022\)](#) suggest that future research should focus on analyzing student motivation through the ARCS approach in e-learning-based physics learning. [Arredondo & Riquelme \(2022\)](#) also recommend replicating the study by adding a pretest to measure initial motivation levels before implementing ARCS-based learning technology. The implications of these findings suggest the urgent need for a more comprehensive research design to evaluate the effectiveness of the ARCS model not only from a motivational perspective but also in terms of complex learning outcomes and other higher-level cognitive competencies.

Overall, the findings of this study suggest that ARCS is a flexible and relevant learning model for diverse situations. The strengths of this study lie in providing a systematic and up-to-date overview of trends, implementation strategies, and the impact of ARCS application in physics education, which can serve as a reference for further research and teaching practices. Its limitations include the relatively small number of articles analyzed and the dominance of topics focused on specific physics content, necessitating future studies with broader coverage of subject matter, educational levels, and learning contexts.

CONCLUSION

Based on a systematic review of 9 articles, research on the application of the ARCS model in physics education from 2016 to 2024 shows consistent development and proven effectiveness in enhancing student motivation, learning outcomes, and conceptual

understanding. The model's adaptability both in direct application and when integrated with flipped classrooms, e-learning, and mobile learning demonstrates its relevance in diverse instructional settings. Teachers can utilize ARCS as a practical framework to design engaging, technology-enhanced physics lessons that foster sustained motivation and learner confidence. Meanwhile, future studies should explore its potential to develop higher-order thinking skills, such as critical thinking, creativity, and problem-solving, particularly within more complex physics topics. Overall, the ARCS model holds strong promise as an innovative, motivational, and future-oriented strategy for advancing the quality of physics education.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

AUTHOR CONTRIBUTIONS STATEMENT

Conceptualization, KPAIA; methodology, SK; data collection, N; formal analysis, YS, MRC; writing original draft preparation, KPAIA, IDAI; writing review and editing, KN; supervision.

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