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Effectiveness of Dick & Carey Instructional Design Model and Learning Attitudes Towards Science Learning Outcomes at UPT SMPN 2 Bayang

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Abstract: Learning outcomes are important for students. In the implementation of learning in schools, efforts to improve student learning outcomes experience many obstacles and barriers. This study aims to test the effect of the Dick & Carey instructional design model and learning attitudes on students' science learning outcomes. This instructional design model is expected to improve students' science learning outcomes compared to the TPACK instructional design model. The type of research used is a quasi-experiment with a Treatment by Block design. This study involved 2 classes, the experimental class, namely the class that was given treatment with the application of the Dick & Carey instructional design model, while the control class was the class that used the TPACK instructional design model. The results of the data analysis showed that students who were taught with the Dick & Carey instructional design model, both those with good or bad attitudes, obtained significantly higher learning outcomes than the science learning outcomes of students taught with the TPACK instructional design model. And there is the effectiveness of the application of the Dick & Carey instructional design model and learning attitudes towards student learning outcomes. In general, learning with the Dick & Carey instructional design model is more effective than learning with the TPACK instructional design model.

Keywords: Design model; Dick & Carey instructional; Learning attitude; TPACK instructional design model

Introduction

Science education at the junior high school (SMP) level plays a strategic role in developing students' scientific thinking skills. Through science learning, students are not only introduced to scientific concepts but also guided to develop critical, logical, and analytical thinking skills to solve everyday problems. Ideally, science learning should connect knowledge with science process skills and foster a positive scientific attitude. However, in practice at various educational institutions, including the UPT SMPN 2 Bayang, the reality is that science learning outcomes are still suboptimal (Wiradarma et al., 2021; Marougkas et al., 2023). Although learning activities are conducted according to schedule and regularly, many students still fail to meet the Minimum Competition Criteria (KKM) on daily assessments. This low learning outcome indicates a mismatch between the learning process and the intended learning objectives. This reflects a more complex problem, rooted not only in material mastery but also in the learning approach used and students' learning attitudes during the learning process. One crucial factor suspected to be the cause of these low

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learning outcomes is the use of an instructional design model that is not fully structured and not sufficiently responsive to the diverse characteristics of students (Müller et al., 2023; Lorenz et al., 2021).

In reality, the instructional approach used tends to be conventional, teacher-centered, and predominantly uses the lecture method with one-way delivery of material (Beigzadeh et al., 2024; Bhardwaj et al., 2025). This learning model provides little room for two-way interaction, exploration, active student participation, or the reinforcement of positive learning attitudes such as curiosity, enthusiasm for learning, and enthusiasm for the subject. Yet, junior high school students are in a highly dynamic stage of cognitive and social development, thus demanding a more flexible, adaptive, and motivating learning approach. Beyond learning strategies, other obstacles also arise from the aspect of learning facilities and infrastructure, particularly in the use of technology (Haleem et al., 2022). Limited technological devices such as projectors, computers, and internet access prevent the implementation of technology-based learning models such as TPACK (Technological Pedagogical Content Knowledge) optimally in all classes (Ismail et al., 2023). This directly impacts the limited variety of media and methods available to teachers and hinders efforts to create an engaging and innovative learning environment. Furthermore, students' learning attitudes are also a crucial factor contributing to low learning outcomes.

Some students exhibit passive learning behavior, minimal participation, lack focus during the learning process, and even tend to show a lack of interest in science material. These learning attitudes reflect low motivation and interest in learning, which will undoubtedly impact academic achievement. If this trend continues, students' potential will not develop optimally, and learning objectives will not be achieved. These problems indicate the need for more planned, systematic learning interventions tailored to students' needs and characteristics (Simón-Grábalos et al., 2025; Van Leeuwen & Janssen, 2019) . One alternative solution is the Dick & Carey instructional design model (Sa'adu Matazu, 2023; Spatioti et al., 2022). This model emphasizes the importance of needs analysis, identification of student characteristics, formulation of learning objectives (Fatimah & Muamar, 2024; Wahyudi et al., 2023), selection of appropriate strategies, and comprehensive implementation and evaluation of learning (Kintu et al., 2017; Schildkamp et al., 2020). With 10 sequential and interrelated stages, the Dick & Carey model can serve as a guide for educators in designing learning that is not only effective in terms of content (Spatioti et al., 2022; Abuhassna et al., 2024), but also efficient in terms of process and has a positive impact on learning outcomes (De Bruijn-Smolders & Prinsen, 2024; Markula & Aksela, 2022).

More than just a technical approach, the Dick & Carey model also provides space for educators to pay attention to affective and behavioral factors in the learning process. Therefore, this model has great potential to be applied in the context of science learning at UPT SMPN 2 Bayang, especially to address the problem of low learning outcomes related to instructional design and student learning attitudes. It is hoped that with a systematic, directed, and oriented approach to student learning needs, this model can increase active student involvement in the learning process and have a positive impact on improving science learning outcomes.

Method

This study used a quasi-experimental method that aims to determine the effect of treatment on the dependent variable in conditions that do not allow random selection of subjects. This study involved two classes that were available at the school, namely one class as an experimental group that was given treatment using the Dick & Carey instructional design model and one class as a control group that used the TPACK instructional design model. The research design used was Treatment by Block Design, which considers two factors, namely the learning model and the students' learning attitudes. Each class was divided into two categories based on learning attitudes, namely good learning attitudes and poor learning attitudes, so that four treatment group combinations were formed: A_1B_1 (Dick & Carey - good attitude), A_1B_2 (Dick & Carey - poor attitude), A_2B_1 (TPACK - good attitude), and A_2B_2 (TPACK - poor attitude).

The research procedure was carried out through three stages, namely the preparation stage, the treatment stage, and the evaluation stage. In the preparation stage, the researcher determined the experimental and control classes, conducted a pretest to determine initial abilities, and grouped students based on learning attitudes. In the treatment stage, the learning process was carried out for three meetings with the material "Vibration and Waves" according to the steps of each instructional design model. Furthermore, in the evaluation stage, a posttest was conducted to measure student learning outcomes, and the data obtained were analyzed statistically to determine the effect of the instructional design model, learning attitudes, and the interaction between the two on the science learning outcomes of grade VIII students at UPT SMPN 2 Bayang.

Results and Discussion

The results of the study showed that the implementation of the Dick & Carey instructional design model significantly improved students' science learning outcomes compared to the TPACK model. This was demonstrated through hypothesis testing, which yielded a P-value <0.05 across all tests, both for overall learning outcomes and learning outcomes based on the classification of learning attitudes (good and bad). Students taught using the Dick & Carey model achieved an average learning outcome score of 86.10, significantly higher than students in the control class taught using the TPACK model, with an average score of 66.40. This difference not only demonstrates the effectiveness of the Dick & Carey model but also indicates that a systematic learning design based on student needs analysis and complemented by formative assessment can improve conceptual understanding and academic achievement.

Data on student learning attitudes were obtained through a 22-item questionnaire administered to 28 students in the experimental class. The results of descriptive statistical data processing indicate that the average learning attitude score is 79.80, the median is 80.5, and the mode is 82, with a maximum score of 88 and a minimum score of 70. The standard deviation value of 4.3 and variance of 18.2 indicate a relatively homogeneous distribution of the data. The total score for all respondents reached 2.234. Based on the data range (88 – 70 = 18) and the number of interval classes (rounded to 6 classes), the interval class length is 3.

Table 1. The Frequency Distribution Results

Interval Class	Frequency	Percentage (%)
70 – 72	1	3.60
73 – 75	3	10.70
76 – 78	8	28.,60
79 – 81	5	17.90
82 – 84	8	28.60
85 – 88	3	10.70
Total	28	100

These data indicate that the majority of students are in the good category, with scores ranging from 76–78 and 82–84, with eight students (28.60%) each. This indicates that the majority of students have a positive learning attitude toward science. This distribution also shows that only one student (3.60%) is in the low score category (70–72). Meanwhile, 11 students (39.30%) scored above 82, indicating a high level of commitment, interest, and discipline in learning. Therefore, it can be concluded that the learning attitudes of students in the experimental class are generally very supportive of the learning process (Nja et al., 2022; Tong et al., 2022), and this is one factor that strengthens the effectiveness of the Dick & Carey instructional design model in improving learning outcomes.

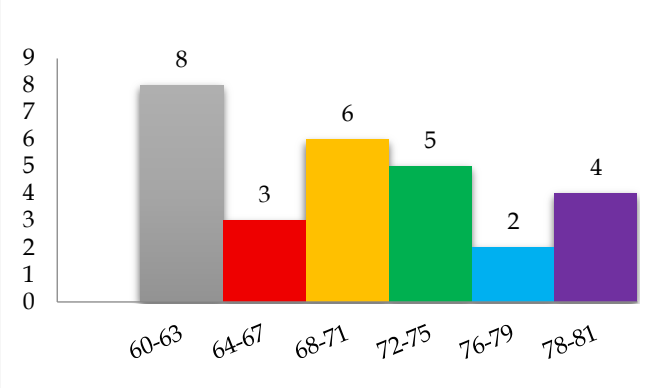

Figure 1. Histogram of learning attitudes of the control class

Based on the histogram of learning attitudes in the control class, the highest frequency of learning attitudes in the control class was 8 students. This highest frequency was in the class interval 60 to 63. The lowest frequency of learning attitudes in the control class was 2 students in the class interval 76 to 79.

Science Learning Outcomes of the Experimental Class

Science learning outcomes of students in the experimental class were obtained through a final test consisting of 7 essay questions. Of the 28 respondents, the average score was 86.10, with a maximum score of 100 and a minimum score of 65. The median of 85, mode of 90, standard deviation of 9.10, and variance of 83.40 indicate a fairly stable and consistent data distribution. The total scores collected by all students reached 2411. The distribution of learning outcome scores was divided into six class intervals with intervals of approximately 6 points. The highest frequency was in two interval classes, 77–82 and 89–94, each with 7 students (25%). This indicates that the majority of students had a high level of understanding of the material taught.

Table 2. Summary of the Frequency Distribution of Learning Outcome Scores

Interval Class	Frequency	Percentage (%)
65 – 70	1	3.60
71 – 76	2	7.10
77 – 82	7	25
83 – 88	5	17.90
89 – 94	7	25
95 – 100	6	21.40
Total	28	100

A total of 18 students (64.30%) scored above 83, indicating a predominance of achievement in the excellent category. Meanwhile, only 3 students (10.70%) scored below 76. This indicates that the Dick & Carey instructional design model implemented in the

experimental class had a positive impact on improving students' science learning outcomes. The results of the study indicate that the Dick & Carey instructional design model had a positive impact on the science learning outcomes of eighth-grade students at the UPT SMPN 2 Bayang. This is evidenced by the average final score of 86.1, with a mode of 90 and a median of 85, indicating that most students achieved high scores and their learning outcomes were in the excellent category (Alonso-Nuez et al., 2024).

The frequency distribution shows that the majority of students (71.30%) scored above 82, specifically in the intervals 83–88, 89–94, and 95–100. Only 3.6% of students fell into the low category (scores 65–70). This demonstrates that learning using the Dick & Carey model successfully encourages the majority of students to achieve optimal results (Sial et al., 2024; Galeboe et al., 2025). This success is due to the systematic Dick & Carey learning steps, which consist of Nugraha et al. (2024): identifying learning objectives, instructional analysis, student analysis, formulating behavioral objectives, developing instruments, designing learning strategies, developing materials, and formative and summative evaluations (Subheesh & Sethy, 2020; Asiah & Festiyed, 2024). The implementation of these steps is able to Onasanya et al. (2024): Accommodate the needs and characteristics of students, which have previously been analyzed in depth (Fatimah & Muamar, 2024); Direct the learning process in a structured manner, making it easier for students to understand abstract science concepts (Parwata et al., 2020); Increase active student engagement, because learning strategies are specifically designed based on goals and needs (Ahshan, 2021; De Bruijn-Smolders & Prinsen, 2024); Provide feedback through formative evaluation, so that errors or misconceptions can be corrected before students take the final assessment (Bessas et al., 2024).

The standard deviation of 9.1 indicates that the distribution of scores is not too far from the average, indicating consistency in achievement among students. In other words, not only a small number of students succeed, but almost all achieve good results. Thus, these results reinforce that the Dick & Carey model is not only effective in improving learning outcomes but also ensures equitable outcomes (Muhab et al., 2024; Ernawati et al., 2021). This means that learning becomes more inclusive, adaptive, and efficient in improving science understanding at the junior high school level (Wulayalin & Suprihatiningrum, 2024; Mukhibat, 2023). Scientific thinking skills and a deeper understanding of science concepts are enhanced in students learning with the Dick & Carey model. A positive learning attitude is further supported by the Dick & Carey model, as it encourages learning activities such as experimentation, discussion, and reflection. Even for students with less positive learning attitudes, the Dick & Carey model still demonstrates superior results (Lee, 2020). This is because Dick & Carey has structured steps and considers student characteristics to adapt teaching materials (Yunita et al., 2023).

Conclusion

In general, learning with the Dick & Carey instructional design model is more effective than learning with the TPACK instructional design model. Learning using the Dick & Carey instructional design model can improve student learning outcomes because each learning step is clear and easy to follow. The Dick & Carey instructional design model is more organized, efficient and effective and the sequence is detailed, the model is one-way, clear and efficient.

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Conceptualization; methodology.; K. P.; validation; formalanalysis; investigation; resources; D., R., data curation: writing—original draft preparation; writing—review and editing.; visualization: Z. Z All authors have read and agreed to the published version of the manuscript.

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The authors declare no conflict of interest.

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