JPPIPA 11(10) (2025)

Jurnal Penelitian Pendidikan IPA

http://jppipa.unram.ac.id/index.php/jppipa/index

"Dick and Carey Instructional Model and Creativity: Their Impact on Elementary Students' Learning Outcomes

Sisri Wahyuni[1*], Darmansyah[1], Zelhendri Zen[1], Zuwirna[1]

[1] Education technology of Postgraduate Program, Universitas Negeri Padang, Padang, Indonesia

Received: June 27, 2025
Revised: August 10, 2025
Accepted: October 25, 2025
Published: October 31, 2025

Corresponding Author:
Sisri Wahyuni
Sisriwahyuni239@gmail.com

DOI: 10.29303/jppipa.v11i10.11900

Abstract: This study investigates the influence of the Dick and Carey instructional model and students' creativity on mathematics learning outcomes among elementary school students. Employing a quasi-experimental design with a 2×2 factorial structure, the research involved 51 fifth-grade students from two comparable schools in the Banuhampu District, West Sumatra. The experimental group received instruction using the Dick and Carey model, while the control group followed conventional teaching methods. Creativity was measured using a validated questionnaire, and learning outcomes were assessed through a posttest aligned with curriculum indicators. The results show that students taught using the Dick and Carey model achieved significantly higher learning outcomes than those taught conventionally. Furthermore, students with higher levels of creativity consistently outperformed their lower-creative peers in both instructional groups. However, statistical analysis indicated no significant interaction between instructional model and creativity level, suggesting the model's universal applicability across diverse learner profiles. The study concludes that the Dick and Carey model is effective in enhancing mathematical understanding regardless of creativity level, offering a structured yet inclusive approach to classroom instruction. These findings provide valuable insights for teachers and curriculum developers aiming to optimize learning through systematic design and the integration of learner creativity.

Keywords: Creativity; Dick and Carey Model; Elementary Education; Instructional Design; Mathematics Learning

Introduction

Greatly instructive for the future generations of academically strong, critically thinking, creatively self-expressing, and socially responsible people is what primary education lays. In a fast-changing global environment, education is called to form students able to adjust to new technologies and the complexities of social realities(Febrian, 2023). Hence, improving student achievement and instructional quality at the primary level must embrace not only the content of learning resources but also the teaching styles and instructional frameworks being used (Sartini et al., 2024).

Mathematics holds a special position among the subjects considered core in elementary education since it develops in students the ability to think logically, systematically, and analytically. Acquiring proficiency in mathematics equips students with essential problem-solving skills that will serve them not just in maneuvering through bordering everyday problems but also uphold their success in a plethora of academic fields (Juldial & Haryadi, 2024). But then, for its real importance, the teaching of mathematics in practice is often dwindled, especially in its ability to develop deep conceptual understanding and for enhancing the

How to Cite:
Wahyuni, S., Darmansya, Zen, Z., & Zuwirna. (2025). "Dick and Carey Instructional Model and Creativity: Their Impact on Elementary Students' Learning Outcomes. *Jurnal Penelitian Pendidikan IPA*, *11*(10), 171–176. https://doi.org/10.29303/jppipa.v11i10.11900

practical application of mathematical knowledge (Fadillah, 2024).

Almost empirical evidence is provided by the Grade V students of Gugus 1 of Banuhampu District to this effect. The mid-semester assessment scores by classroom teachers show that quite a huge population of students has not reached the competency minimum standard of 70. The following table shows the distribution of mathematics achievement among the six elementary schools within the cluster-a clear evidence for pedagogy-changing.

Table 1. Distribution of Grade V Students' Mathematics Learning Outcomes Based on Mid-Semester Assessment (PTS) in SDN Gugus 1, Banuhampu District, Academic Year 2024/2025

School Name	Total	Average Score	Number Passed	Number Failed
SDN 05 Kubang Putiah	24	67.81	10	14
SDN 04 Kubang Putiah	27	65.24	12	15
SDN 07 Kubang Putiah	22	67.06	10	12
SDN 17 Kubang Putiah	14	69.36	6	8
SDN 23 Kubang Putiah	27	62.04	9	18
SDI Ibnu Syam	60	66.53	21	39
Total	174	–	68	106

Source: Head of Gugus I, Kubang Putiah Cluster, Banuhampu District, Agam Regency (2024)

More than half of the students (60.9%) failed to attain the stated standards of competence, thereby signifying the existing adverse condition of many students in mastering mathematical concepts and, thus, clearly highlighting the urgent need (Maduratna & Setyawan, 2020; Najoan et al., 2023; Siagian et al., 2020)

Observation made across several schools in the cluster has shown that traditional methods have been a major contributor to the dismal results. Teachers largely depended on lectures and required students to do repetitious assignments which indicated that students became passive recipients of knowledge rather than active participants in their own learning process (Shafira & Minsih, 2022). The absence of interactivity and exploration in the instruction-style reduces student engagement and consequently limits deep conceptual understanding.

Moreover, this teacher-oriented paradigm restrains the development of higher levels of thinking, such as creative problem-solving and analytic reasoning. Mathematics education should ideally be beyond memorizing formulas; it should enable learners to adaptively operate across contexts through cognitive resources use (Mufarrohah & Setyawan, 2024).

Creativity-an imperative usually overlooked in the learning process-is defined as the ability to generate original ideas, think fluidly and flexibly, and elaborate ideas with depth and (Nurjan, 2018; Siregar, 2020; Sitepu, 2019). Its importance lies in creating relevant and impacting learning experiences.

While creativity is an essential attribute, the feature is poorly developed in students in mathematics. As evidenced from Grade V classrooms in Gugus 1, students tend to emphasize memorization of facts and stringency of procedures; thus, little opportunity for them to experience different techniques in problem-solving or working with each other in collaborative tasks (Meilindya et al., 2022). Because of lack creative engagement, the learning environment becomes monotonous, uninspiring, and therefore divorced from reality.

To address these issues, the implementation of an integrated and systematic instructional approach is vital. The Dick and Carey Instructional Design Model is one such model that aligns the objectives of instruction with the characteristics of learners, appropriate teaching strategies, and assessment methods in one clear system.

This model has been proven effective empirically. According to Maharani (2017), it was observed that the students who were taught using the Dick and Carey model performed better academically compared to those who undertook learning through more conventional means. Similarly, Anwar & Anis (2020) remarked that the model could enhance the appeal and effectiveness of instruction as it provides more student autonomy as well as active participation in the learning process.

The model also, by nature, supports an environment conducive to collaborative learning. As Setyawan & El Hakim (2023) point out, "group discussions and project assignments lead to interaction among peers, solving problems collaboratively, and communicating better-all of which enrich their conceptual understanding and create a more dynamic classroom atmosphere."

However, out of the above benefits, studies have not extensively examined the relationship between the Dick and Carey model and the creativity of students in mathematics instruction. Much of the previous research focused on cognitive achievements, often at the expense of the combined affective and creative learning domains

(Rindengan, 2023). There is thus a necessity for investigating how structured instruction design might also be engaged in academic development and creativity.

This research article, therefore, investigates the influence of the Dick and Carey Instructional Design Model in collaboration with student creativity on mathematics achievement among fifth-grade elementary students. Being in theoretical perspective, the research extends discourse on instructional design by integrating the role of creativity within systematic pedagogical planning. Practically speaking, the outcomes are meant to enlighten educators and curriculum developers on ways to make instructional content and processes more effective and at the same time innovative, interesting, and well designed to the developmental needs of primary school learners.

Method

A quasi-experimental design characterized by nonequivalent posttest-only control group-type employing a quantitative approach was adopted in this research. The main purpose was to study the effect of the Dick and Carey Instructional Design Model and student creativity on mathematics learning outcomes. The factorial design 2x2 was used to determine both the main effects and their interaction between the type of instructional model (Dick and Carey vs conventional) and the level of creativity (high vs low) following the guidelines by Lestari & Yudhanegara (2019)).

The population for the study consisted of 174 fifth graders from six elementary schools in the Gugus I Kubang Putiah cluster, Banuhampu District, Agam Regency, in the academic year 2024/2025. Two comparable schools were selected through purposive sampling. SDN 05 Kubang Putiah became the experimental group with 24 students, while SDN 23 Kubang Putiah became the control group with 27 students. Comparability in terms of academic performance, competence of teachers, and classroom conditions were the bases for selection according to Sundayana (2018)

For gathering data, two major instruments were used: the creativity questionnaire and the mathematics achievement test. The creativity test, adapted from Riduwan (2019), used a Likert-type scale measuring four basic dimensions: fluency, flexibility, originality, and elaboration, based on the conceptual framework by Sitepu (2019). The mathematics test consisted of multiple-choice items related to geometry and spatial reasoning indicators from the curriculum.

To test the validity and reliability of the instruments, they were subjected to expert judgment for content validity and item analysis by Pearson's Product-Moment Correlation.

The implementation of the research was in three consecutive basic principles. The first was the preparation where instructional materials and instruments were developed, validated, and revised; initial creativity data were gathered for students to be classified into appropriate subgroups. The implementation was a phase where the experimental group was treated according to the Dick and Carey model, emphasizing clear instructional objectives, sequential strategies, student involvement, and formative assessments. The control group was taught through conventional methods, with an emphasis on teacher explanations, guided examples, and independent work. During the third stage, posttests were administered and scores processed for statistical analysis.

Minitab was used for data analysis. The assumptions included the Anderson-Darling test for normality and the F-test for homogeneity of variance; hence, the appropriate statistical tests were selected, be it T-test for independent samples or Welch's t-test for group means comparisons; and a two-way ANOVA to analyze the interaction effect of instructional model and levels of student creativity.

This comprehensive and structured methodology lays a strong foundation for evaluating efforts in instructional design with creativity to promote mathematics learning among elementary students.

Result and Discussion

The current investigation is meant to discern the effect of Dick and Carey instructional design on students' level of creativity and their combined effect on mathematics learning outcomes at elementary level. The very title of the study is understood as "Dick and Carey Instructional Models and Creativity: Their Impact on Learning Outcomes among Elementary Students". Both of the dual foci are reflected here. One of the objectives of this research is to assess the effectiveness of the Dick and Carey model as a structured instructional framework. Another focus is how creativity of the students, regardless of their entry level, mediates this model's effect on the academic performance of the students. Instructional design and student creativity inform how educational strategies can be implemented optimally in the context of varying abilities of individual students in elementary classrooms.

Findings indicate that the Dick and Carey model considerably raised the learning outcomes, evidenced by the higher average score of the experimental group (M = 81.67) compared to that of the control group (M = 74.81).

This supports the hypothesis that systematic design of instruction under careful implementation leads to measurable changes in academic performance at elementary levels.

Table 2. Descriptive Statistics of Mathematics Learning Outcomes

Group	N	Mean	Max	Min	Std. Deviation
Experimental (Dick & Carey)	24	81.67	100.00	65.00	8.74
Control (Conventional)	27	74.81	89.00	60.00	9.65

An improvement in student performance can be gauged against the systematic phases of the Dick and Carey instructional model, which lay particular stress on specifying clear learning objectives, the selection of narrowly focused instructional content, matching assessments with objectives, and building in reliable mechanisms for (Hani et al., 2024; Setyawan & El Hakim, 2023). The merit of this model lies in providing a systematic approach for instruction that differs from the traditional view of merely delivering content, so as to engage comprehensive, learner-centered teaching strategies that are tactful and responsive to the student's needs.

Another important element of creativity possessed by students is presented in this study. This research contributes to the argument that creativity, often stifled in highly structured instruction, can thrive within a well-structured pedagogical design. As previously pointed out by Asma (2022) and Kholidatur Rodiyah (2021), one must also bear in mind that creativity is not restricted to flexible or unstructured learning environments. The findings of the study support that position in that in the experimental group, students with high creative potential showed significantly better learning outcomes (M = 90.29) and even those with lower creativity still outperformed the control group.

Table 3. Mean Scores by Instructional Model and Creativity Level

Creativity Level	Group	N	Mean
High	Experimental	10	90.29
High	Control	9	81.78
Low	Experimental	14	74.50
Low	Control	18	66.67

This research provides compelling evidence supporting the idea that creativity flourishes within a structured learning environment rather than being constrained by it. Although the Dick and Carey model is considered procedural, it does provide that scaffolding for students to express and develop their creative ideas in goal-oriented, directed activity. When used in conjunction with formative assessments, reflective practices, and collaborative opportunities, the model engenders cognitive development as well as the emergence of creative faculties (Hastutie & Ramli, 2024).

In addition, the ANOVA tests showed no significant interactivity effect of the instructional model and the level of students' creativity ($p > 0.05$; $F=0.97$). This endorses the applicability of the Dick and Carey model to a wide variety of learner profiles, indicating that its success is not necessarily predicated on the initial levels of creativity Being found, this underscores the model's capacity to help in developing equitable learning environments in classrooms with students of diverse traits.

Most of these conclusions run parallel to results from and on the work of Khoiron et al. (2020), who utilized the Dick and Carey framework in their studies of social studies. These authors focused on the link between instructional goals closely matched with content and evaluation processes, making their learning very meaningful. In line with these findings, the current investigation illustrates similar insights for elementary-level mathematics instruction in which creativity acts as both a facilitator and an outcome of structured learning.

From a pedagogical angle, the major strength of the Dick and Carey model belies its internal coherence. Its ten interrelated stages-from formulating objectives to final assessment-follow a systematic structure, as exemplified by the ADDIE model, ensuring that each instructional component is purposely designed and interconnected (Setyawan & El Hakim, 2023). This while decreasing complexity and disunity among course concepts supports clearer instructional delivery that promotes higher student engagement and comprehension.

Formative feedback is positioned as one key instructional practice by this model. According to Hastutie & Ramli (2024), instructional models that have their assessment loops in dynamism enhance learners' academic development, self-regulation, and reflective thinking skills.

Nurturing academic development among these creative outliers in the experimental group is noteworthy. Their improvement supports the Dick and Carey model's inclusive nature. Effective instructional design, says Kholidatur Rodiyah (2021), have to either promote diversities of learners not only by ability but also in regards to cognitive preference, motivation, and prior experiences. Making the learning process more coordinated and stable promotes learning opportunities for even the less creatively inclined to engage, take risks intellectually, and achieve mastery.

Conversely, the limitations of the study arise, as encouraging as the results might be. First, the short duration of the intervention created a difficulty in assessing the long-term instructional effects on knowledge retention and transfer. Second, self-reported data on creativity may not fully capture the complexities involved in students' actual behaviors and cognitive engagement in classroom environments. Lastly, the sample contextually limits finding extrapolation to a wider educational context.

Future research must broaden investigations into creativity and structured instruction by considering integrations of Dick and Carey methodology with emergent technologies, such as interactive learning platforms and AI-driven personalization tools. Besides that, qualitative methods like classroom observations and student interviews can also enrich findings on how learners experience and respond to structured instructional environments.

The Dick and Carey instructional model and the student creativity combined have been shown in this study to deeply affect meaningful learning outcomes for mathematics at the elementary level. The model provides a tried-and-true, reasonably equitable scaffold for instruction upon which creativity builds depth experiences and invests students; over time, these become mutually reinforcing, ultimately allowing students to excel academically as well as develop their cognitive and creative faculties.

Conclusion

This research proves that elementary school students can significantly perform better in mathematics under the Dick and Carey model of instruction. The model could also work in a situation of varying creativity of students, as students of high and low creativity in the experimental group performed better than those of the control group statistically. The results have proved the differences to be significant, and the absence of interaction effects suggests that the benefits of the model are generalizable for all levels of creativity. Therefore, no doubt, this model proves to be inclusive, structured, and clarity-oriented in instruction that would warrant itself as a reliable model for improving the learning outcome in the primary education of mathematics. Future researchers should be encouraged to evaluate its amalgamation with digital technologies and a long-term application in various educational contexts.

Acknowledgments
The authors would like to express their sincere gratitude to Prof. Dr. Darmansyah, ST, M.Pd., as the primary academic supervisor, for his invaluable guidance, constructive feedback, and consistent encouragement throughout the research and writing process. His expertise in instructional design greatly enriched the development of this study.
The authors also extend their appreciation to Prof. Drs. Zelhendri Zen, M.Pd, Ph.D. and Dra. Zuwirna, M.Pd., Ph.D., whose insights and support during the methodological planning and analysis stages provided important contributions to the overall quality of this research. Their collegial assistance and critical input were instrumental in ensuring the completion of this article.

Author Contributions
All authors actively contributed to the process of writing this article. Each author made significant contributions, including data collection, analysis, and drafting different sections of the article. Every individual involved provided new ideas, valuable input, and complementary wording to produce this article. Through their collective contributions, the authors have successfully created a comprehensive and in-depth article.

Funding
This research received no external funding.

Conflicts of Interest
The authors declare no conflict of interest

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