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Implementation of Jean Piaget's Cognitive Development Theory in Science Learning in Elementary Schools and Its Relevance to SDGs 4

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Abstract

Quality education (SDGs 4) demands a paradigm shift from passive learning to active knowledge construction, particularly at the Elementary School (SD) level as the foundation for scientific literacy. In reality, Science (IPA) learning in elementary schools is still dominated by abstract lecture methods, which conflict with the cognitive needs of students, the majority of whom are in the concrete operational stage (ages 7–11). This study aims to analyze and synthesize the practical implementation of Jean Piaget's cognitive development theory in elementary school science learning and its relevance in supporting the achievement of SDGs 4 targets. The research employs a literature review method with a descriptive-analytical approach, examining various scientific studies related to the application of Piaget's constructivist principles within the science context. The synthesis results identify three pillars of effective implementation: 1) The Shift in the Teacher's Role, which involves the teacher transitioning into a facilitator who designs cognitive *disequilibrium*; 2) The Centrality of Concrete Media, which mandates the use of *hands-on* media (traditional and digital, such as interactive simulations) to bridge abstract concepts into observable (*concrete*) thinking; and 3) Relevant Learning Models, specifically the application of constructivist models like *Inquiry-Based Learning* and *Discovery Learning* that directly train students' logical skills. The conclusion indicates that science learning aligned with the concrete operational principles significantly improves students' concept comprehension, critical thinking skills, and scientific literacy, which are central to achieving Quality Education targets (SDGs 4.1 and 4.7). Therefore, a mandatory transition from *textbook-centered* instruction to *activity-centered* instruction in elementary schools is recommended.

Keywords: Jean Piaget, Cognitive Development, Concrete Operational, Science Learning, SDGs 4, Constructivism.

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INTRODUCTION

Education is the main foundation for achieving the 2030 Agenda for Sustainable Development (Sustainable Development Goals/SDGs), where Goal 4 (SDG 4) aims for "inclusive and equitable quality education and promotes lifelong learning opportunities for all" (Ferguson & Roofe, 2020). In the context of basic education, SDG 4 target 4.1 emphasizes achieving minimum proficiency levels in reading, mathematics, and science for all children. However, science literacy attainment in Indonesia still shows a gap, especially in the ability to understand basic concepts and apply them in real-world contexts—one of the core indicators in measuring learning quality. Science (IPA) as a strategic subject for building the foundation of scientific literacy in Elementary Schools (SD) should ideally be taught through scientific investigation and direct experience. However, various findings indicate that science learning practices in the field are still dominated by lecture methods, memorization activities, and a lack of use of concrete media suitable for students' cognitive development (Syarifuddin et al., 2024). This abstract, theoretical, and teacher-centered pedagogical pattern contradicts research findings that call for a shift from passive approaches to active knowledge construction (Baldock & Murphrey, 2020).

In this context, Jean Piaget's cognitive development theory has very strong relevance. Piaget emphasizes that knowledge is constructed by the child through active interaction with their environment (Maspul et al., 2023). At elementary school age, the majority of children are in the concrete operational stage (7–11 years old), which is the stage where children begin to be able to think logically but are still highly dependent on real objects and direct experience (Zein, 2016). Thus, science learning without the involvement of concrete media—whether physical objects or digital simulations that can be manipulated—has the potential to create misconceptions, learning barriers, and ultimately disrupt the achievement of SDG 4.1 indicators related to mastery of basic science concepts.

Although Piaget's theory has long been recognized, a research gap still emerges in the realm of literature review, especially regarding how this theory is comprehensively practiced in science learning in elementary schools. So far, most research focuses on one separate aspect, for example, the effectiveness of traditional concrete media, or the effectiveness of digital simulations, or specific learning models such as Inquiry-Based Learning. There is no existing literature synthesis that integrates these three important components—learning models, constructivist strategies, and traditional and digital concrete media—into a single framework that is consistent with the characteristics of the concrete operational stage. This gap makes it difficult for teachers to design holistic learning that aligns with the cognitive needs of children and the demands of SDG 4.

Therefore, this article aims to synthesize various scientific studies discussing the implementation of Piaget's cognitive development theory in elementary school science learning. The focus of the study is directed at how learning models, investigative strategies, and the use of concrete media (physical and digital) can be appropriately combined to facilitate meaningful knowledge construction. By generating a comprehensive literature mapping, this article is expected to make a substantive contribution to efforts to improve the quality of science learning and support the achievement of SDG 4 indicators,

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especially 4.1 related to mastering basic science skills through pedagogical practices suitable for children's cognitive development.

METHODS

This research uses the literature review method with a descriptive-analytical approach. This approach was chosen to examine, identify, and interpret various relevant scientific sources to gain an in-depth understanding of the implementation of Jean Piaget's cognitive development theory in Elementary School Science (IPA) learning, and its relevance to Sustainable Development Goal (SDG) number 4 on quality education (Samara & Kotsis, 2023).

The main data sources for this study include classic and modern textbooks, national and international journal articles (obtained from Google Scholar, SINTA, and Scopus), and educational policy documents such as the Merdeka Curriculum and SDG 4.1 indicators.

The review procedure was carried out through three main stages: Literature Identification The search was conducted using a combination of keywords such as “Piaget theory,” “concrete operational,” “elementary school science learning,” “concrete media,” “constructivist learning,” and “SDG 4 education quality.” Literature was selected based on inclusion criteria: thematic relevance, up-to-dateness (the last 10 years, except for classic Piaget references), and source credibility.

Content Analysis with a Descriptive-Critical Approach At this stage, each source was analyzed to find key concepts, research results, learning models, and empirical findings related to the implementation of Piaget's theory. Content analysis was carried out critically through several systematic steps to prevent synthesis bias, namely: (a) Identifying the researcher's position: finding the main argument of each article, for example, regarding the effectiveness of concrete media or the challenges of implementing constructivism. (b) Cross-checking between researchers: comparing findings from various sources that have thematic similarities to see consistency, methodological differences, and the strength and weakness of the arguments. (c) Contrasting views: contrasting articles that have opposite results or different approaches (e.g., studies emphasizing physical media vs. digital media; or inquiry-based vs. discovery learning) to avoid the dominance of one perspective. (d) Triangulative validation of literature: checking whether certain findings are also supported by policy documents, meta-analyses, or other relevant educational theories so that the interpretation is not biased towards a single study. (e) Data reduction and categorization: selecting the most relevant findings and grouping them according to study themes, such as the concrete operational stage, constructivist strategies in science, concrete media, and the connection to SDG 4 indicators.

Thematic Synthesis Findings that have gone through critical analysis are then combined into main themes to build a comprehensive understanding. The synthesis was carried out by linking: Piaget's cognitive development principles, implementation of science learning models and strategies, use of traditional and digital concrete media, and its relevance to SDG 4 indicators, especially Target 4.1 regarding minimum proficiency level in science.

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The data analysis technique used is descriptive-critical, which not only presents the content of the literature but also analyzes, compares, and evaluates the argumentation among researchers before drawing a conceptual conclusion. This approach ensures that the final synthesis is unbiased and represents a complete, balanced, and contextual understanding of the implementation of Piaget's principles in Elementary School Science learning (Creswell, 2014).

RESULTS AND DISCUSSION

The Paradigm Shift: From Passive Reception to Active Construction

Consistent findings from various studies, as revealed by (Triani & Pratiwi, 2023), show that the core of Piaget's implementation is an essential shift from passive learning to active learning. Students in the concrete operational stage do not learn optimally just by listening to lectures about abstract concepts (e.g., "photosynthesis is..."). Instead, Piaget's theory fundamentally implies that knowledge must be constructed by the student, not transferred from the teacher. In the context of Science, this means teachers must act as facilitators who design cognitive "disequilibrium"—situations that intentionally challenge students' current understanding. For example, instead of saying "heavy objects sink, light objects float," the teacher provides various objects (a small stone that sinks, a large wooden boat that floats) and asks students to investigate and formulate the principle of density themselves. The process of accommodation and assimilation that occurs during this investigation is what is called learning, confirming that meaningful learning is achieved through active participation (Apriyani et al., 2021).

This paradigm shift from passive reception to active construction is a major pillar in contemporary education, closely based on the constructivist theories of Jean Piaget and Lev Vygotsky. This transition recognizes that learning is a dynamic process where learners actively interact with their environment to construct knowledge (Sumarna & Gunawan, 2022). Therefore, the constructivist approach advocates for student-centered pedagogical models, where instructors transform into facilitators, rather than traditional content deliverers, whose task is to help learners navigate knowledge and create meaning (Perkowska-Klejman & Górka-Strzałkowska, 2023). Studies reinforce that students involved in active learning strategies show higher levels of critical thinking and scientific literacy, strengthening the idea that students must shift from passive information recipients to proactive meaning builders in their educational journey (Xue et al., 2024) (Olsen & Pilson, 2022).

Furthermore, this shift from passive reception to active construction has significant implications for curriculum development and teaching methodology. The incorporation of constructivist frameworks in educational practice is seen as effective through the application of constructive alignment in course design, which closely connects learning activities and assessment with desired outcomes (Morselli, 2018). Morselli notes that integrating these techniques increases student initiative and engagement with the material. In the context of evolving educational needs, it is critical for curricula to align with this active learning paradigm to effectively prepare students for real-world challenges, fostering lifelong

learning and adaptability (Sun, 2024). Collectively, the research supports the importance of redefining the educational environment to emphasize active knowledge construction, making the students' processes of assimilation and accommodation the core of all learning activities.

The Centrality of Concrete Media and Hands-On Activities

The main characteristic of the concrete operational stage in Elementary School students is their essential dependence on physical reality. Elementary school students can only think logically about something they can see, touch, or manipulate; therefore, science learning without concrete media and hands-on activities is a pedagogical failure. This need for physical clarity is validated by the study (Yao & Shi, 2024) which found that the use of physical media, such as a torso (concrete), significantly improves students' understanding of body organs (abstract concept) compared to two-dimensional representations in books. This principle applies universally in Science: to understand Changes in the State of Matter, students must actively conduct experiments melting ice and boiling water; to understand Magnetic Properties, they must be given magnets and various objects to classify; and to understand Electric Circuits, they must assemble the components themselves. These hands-on activities are not just "play," but essential bridges provided by the teacher so that students' logic can operate on real problems.

The centrality of concrete media in the learning process has now evolved, no longer relying solely on traditional physical tools (models and aids), but also involving modern technology. Traditional concrete media, which refers to physical objects proven effective in facilitating the understanding of abstract concepts, is now complemented by digital concrete media. With the development of technology, interactive simulations, Augmented Reality (AR), and Virtual Reality (VR) offer a new dimension. For example, PhET simulations provide a virtual environment that allows students to conduct scientific experiments interactively and collaboratively without needing a complete physical laboratory (Yudiyanto et al., 2022). In this way, digital media not only complements the limitations of physical tools but also expands the way students understand and interact with subject matter, keeping the learning experience concrete even in a virtual environment.

Along with the adoption of digital media, hands-on activities are gaining strength in boosting student engagement and strengthening skill development. This active approach not only increases motivation but also students' critical thinking skills, as shown in research examining the use of interactive learning media (Zuhro et al., 2023). Through digital media such as AR and VR, students can engage directly with the content they are learning, creating a deeper and more authentic learning experience (Sari et al., 2021). In addition, the use of digital media facilitates collaboration among students, encouraging them to share and create knowledge collectively, which is in line with object-based learning methods (Porcedda, 2021). Thus, the integration between traditional and digital concrete media brings significant potential in increasing the effectiveness of education, making learning not only informative but also interactive, stimulating creativity, and supporting the optimal mastery of logic for elementary school students.

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Relevant Learning Models: Inquiry and Discovery

The results of the literature synthesis highlight that the Inquiry-Based Learning (IBL) Model is one of the learning models that is highly aligned with Piaget's constructivist principles, reflecting the student's role as an "active scientist." This model involves students in an investigative process that encourages them to ask questions, explore, and discover knowledge through direct experience (Baldock & Murphrey, 2020). In its implementation in Elementary School Science, the teacher presents a phenomenon or problem (for example, "Why do plants placed in the dark wilt?"). Students are then encouraged to formulate questions, design simple investigations, collect data, and draw conclusions. This process directly trains the logical skills characteristic of the concrete operational stage, such as observation, classification, and cause-and-effect analysis. The IBL approach is considered very effective in improving critical thinking skills because students do not just remember information, but also learn to analyze and evaluate data (Reinmann, 2019), and even supports the development of collaborative skills which are important in the context of 21st-century learning (Cutajar, 2024).

The second dominant model is Discovery Learning, which emphasizes the discovery of knowledge by students independently or with minimal guidance from the teacher (Maulyda & Umar, 2021). Unlike IBL which focuses on investigating a problem, Discovery Learning is based on giving students the freedom to explore and interact with learning material so that they can build their own understanding based on relevant experience (Kejora, 2020). For example, in the topic of animal classification, students are not told about the concept of vertebrates, but are given various pictures of animals and asked to find the most logical basis for grouping—an active process that strengthens Piaget's cognitive schemes. This method plays a key role, especially in STEM (Science, Technology, Engineering, and Mathematics) learning, where students are expected to discover basic principles through experiments (Suzanti et al., 2023).

The inquiry and discovery learning models reflect a strong synergy in the constructivist approach, where both models prioritize the active role of students in the learning process. Research shows that the combination of these two models allows students to not only be engaged but also significantly increases their motivation and learning satisfaction (Mardiana et al., 2023). Along with technological developments, the application of these two methods is further strengthened by the use of interactive digital media. Technology, such as simulations or augmented reality-based applications, is not only capable of attracting students' attention but also effectively fosters a spirit of exploration and facilitates collaborative learning in the classroom (Rudyanto & Destia, 2023). By prioritizing direct experience through these models, learning is multidimensional and prepares students to face real-world challenges, which is the core of quality education.

The Linkage of Piaget's Theory Implementation with SDG 4 Achievement

The implementation of Piaget's learning theory is closely related to the achievement of Sustainable Development Goal 4 (SDG 4), which emphasizes inclusive and equitable quality education

for all. Piaget argues that learning occurs through an active process of knowledge construction where students learn through direct experience and interaction with their environment (Purba et al., 2024). This theory underpins the inquiry and discovery approaches in education, which directly contribute to the target of Effectiveness and Relevance (Target 4.1). By aligning Science teaching with students' cognitive stages, concept understanding becomes deeper and more meaningful, not just short-term memorization. The implementation of these learning methods, through exploration activities, fundamentally improves the effectiveness and quality of learning.

Furthermore, the application of Piaget's principles in the classroom is also vital for achieving the target of Skill Development (Target 4.7). Inquiry-based and hands-on activities directly hone critical thinking, problem-solving, and scientific literacy skills (Nupen et al., 2024), which are essential skills needed for students to face global challenges and sustainable development (Ferguson & Roofe, 2020) (Saini et al., 2022). In addition, Piaget's theory supports the fundamental principle of Inclusivity in the SDGs. Because this theory emphasizes that every child develops through the same stages but at different speeds, the student-centered approach allows teachers to accommodate individual differences through differentiation, making Science learning more equitable and inclusive (Boned-Gómez et al., 2023).

Learning models guided by Piaget's constructivist theory not only result in high academic achievement but also contribute to the development of social and emotional skills which are an integral part of quality education. When education is implemented with a constructivist approach, students develop interpersonal skills and an understanding of the complex dynamics in their social environment (Alonso-García et al., 2019) (Nazar et al., 2018). In short, applying Piaget's theory in Science learning is not just about generating high engagement, but about respecting the way the elementary student brain works and preparing them to contribute to a sustainable and inclusive society. Thus, the application of Piaget's theoretical principles fundamentally plays a role in achieving SDG 4 goals, ensuring that education is not just the transfer of knowledge but also the development of character and skills that can be used in daily life.

CONCLUSION AND SUGGESTION

This literature review confirms that Jean Piaget's cognitive development theory, especially the concrete operational stage, remains a relevant pedagogical foundation for Science learning in elementary schools. The synthesis of the literature shows that Piaget provides the strongest framework for understanding how elementary school students construct scientific concepts through direct interaction with the environment, and this framework becomes even more important when contextualized with the demands of scientific literacy and the SDG 4.1 indicator regarding the achievement of basic science competencies. Furthermore, the findings indicate that Piaget's principles are not only compatible but can also be extended through the utilization of digital technology—such as interactive simulations, simple virtual laboratories, and digital manipulative media—which are capable of replicating concrete experiences for students in various school conditions.

Based on these theoretical implications, the main recommendations are directed not only at practitioners but also at policymakers. At the national level, the Ministry of Education needs to prioritize the policy of procuring hybrid concrete media (physical and digital), especially for schools in remote, isolated, and disadvantaged (3T) areas, so that the gap in access to concrete learning experiences can be minimized. Furthermore, the integration of Piaget's constructivist theory into teacher training programs based on the Merdeka Curriculum needs to be strengthened so that teachers are able to design Science learning that is appropriate for students' cognitive development stages, whether through physical media or technology. At the level of educational institutions, LPTKs (Teacher Training Institutions) are expected to enrich the curriculum with modern constructivism-based Science learning design practices that combine Piaget's classic approach with educational technology innovations. Future research is recommended to examine the long-term impact of the integration of hybrid concrete media based on Piaget's theory on scientific literacy and problem-solving abilities of elementary school students on a sustainable basis.

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Contribute of Behaviorism: Optimizing Skinner's Principles for Prosocial Character and SDG 16 in Primary Education

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Abstract

The problems of deviant behavior and low discipline among elementary school students remain a challenge in creating a conducive learning environment. Most previous studies have focused more on cognitive aspects, while the dimension of prosocial character and its contribution to Sustainable Development Goals (SDGs) 16 has not been widely studied. This study aims to analyze the application of reinforcement principles (positive and negative reinforcement) and shaping behavior in shaping the discipline and prosocial behavior of elementary school students, as well as to explain its contribution to the achievement of SDG 16 through peaceful and inclusive education. This study uses a qualitative approach with a library research method. Data were obtained from various academic literature such as reputable journals, books, and research reports relevant to B.F. Skinner's operant conditioning theory. Data analysis was conducted using descriptive qualitative methods through the stages of reduction, categorization, and interpretation of literature to find patterns of correlation between behavioral reinforcement and character building in students. The results showed that consistent reinforcement increased students' intrinsic motivation, self-discipline, and social responsibility, while shaping behavior played a role in gradually forming prosocial behavior. The new findings from this study produced a conceptual model of Behaviorism-Contributive, which is the integration of Skinner's theory with social-emotional values relevant to the context of Indonesian primary education. Theoretically, this model broadens the neo-behavioristic perspective in education, while practically, it can be used as a reference for teachers and educational institutions to create a peaceful, inclusive, and equitable learning ecosystem in line with SDG 16.

Keywords: behaviorism, reinforcement, shaping behavior, student character, SDGs 16.

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INTRODUCTION

Elementary schools play a fundamental role in shaping students' cognitive abilities and character by instilling values of discipline, responsibility, and good social behavior. However, both globally and domestically, the challenge of student misbehavior has become a critical issue that disrupts the effectiveness of learning. A comprehensive report by Valiente et al. (2020) highlights that emotional

socialization in the classroom, which includes behavior regulation, is greatly influenced by teacher-student interactions and peer dynamics. When this regulation fails, problems such as lack of compliance with rules, disruptive behavior (e.g., off-task behavior), and lack of prosocial initiative become major obstacles. These conditions create a less conducive learning atmosphere and hinder students' social and academic development.

This fact is supported by studies in the Indonesian context that show low student awareness of school regulations (Zabrina, 2024), while in other regions, such as Asia and Africa, similar problems have been found in the form of mild aggression, classroom noise, and low learning perseverance (Peras et al., 2023). It is important to emphasize that these issues are not merely matters of discipline, but rather a reflection of the failure to develop prosocial character and self-regulation, which are the foundations of a civilized society. This condition shows that the development of discipline and prosocial behavior at the elementary level requires an evidence-based approach and effective pedagogical strategies.

One of the most relevant and proven effective approaches to overcoming these behavioral challenges is B.F. Skinner's behaviorism theory, particularly the concept of operant conditioning. The principles of reinforcement and shaping behavior allow teachers to systematically reinforce positive behaviors such as obedience, responsibility, and cooperation through the provision of appropriate consequences. Empirically, positive reinforcement (e.g., praise or rewards) and negative reinforcement (removal of unpleasant consequences) have been shown to increase learning motivation and reduce disruptive behavior (Chen, 2023; Rafi et al., 2020).

Although numerous studies demonstrate the effectiveness of this theory, most research still focuses on improving academic achievement or reducing simple negative behaviors. There is a significant gap in the literature linking behaviorism to: 1) the formation of complex prosocial character, and 2) its contribution to the global agenda, particularly Sustainable Development Goal (SDG) 16 (Peace, Justice, and Strong Institutions), which calls for the instillation of inclusive and non-discriminatory values from an early age.

Based on this background, this study aims to identify and analyze the application of reinforcement principles (positive and negative reinforcement) and behavior shaping in the formation of discipline and prosocial behavior in elementary school students, as well as to explain its contribution to the achievement of SDG 16 through peaceful, inclusive, and equitable education.

METHODS

This section should have the meaning of the state of the art of science and technology, the sophistication of viewpoints and approaches, the potential acquisition of novelties, new to science, and completeness of work, not only repeating previous research of the same type, but also not mutating methods and objects.

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This study adopts a qualitative approach using library research methods. This method was chosen based on the research objectives, which are to describe the pattern of application of Skinner's behaviorism theory in the formation of prosocial character and to examine its contribution to the achievement of SDG 16. The library research method allows researchers to construct a Contributive Behavioristic Conceptual Model through in-depth synthesis and reinterpretation of B.F. Skinner's classic operant conditioning theory in the context of contemporary issues. The main data collection technique was the search and documentation of credible academic literature, including Theoretical Primary Sources (Skinner's fundamental works) and Empirical Secondary Sources (reputable journals and recent research reports on the application of behaviorism in education).

Data analysis was conducted using qualitative descriptive techniques involving three systematic stages. The first stage was Data Reduction, which involved sorting the literature to focus the study on the relationship between reinforcement and shaping with behavioral outcomes (character) and social contributions. The second stage, Data Presentation (Categorization), grouped the findings to identify common patterns of application (effective positive reinforcement) and patterns of the relationship between behaviorism mechanisms and the development of prosocial character and support for SDG 16. The final stage, Drawing Conclusions (Conceptual Synthesis), formulates a holistic interpretation of these patterns to produce a Conceptual Behavioristic-Contributive Model as an original finding. The validity of this literature study's results is established through two techniques: Source Triangulation (comparing the consistency of findings across studies as an indicator of internal validity) and Credibility Audit Trail (ensuring the selection of literature from reputable journals and the traceability of the data synthesis process).

RESULTS

This study presents comprehensive findings from a synthesis analysis of the application patterns of B.F. Skinner's principles of operant conditioning, namely reinforcement and behavior shaping, as the main pedagogical mechanisms in the context of elementary schools. This synthetic analysis directly resulted in the identification of patterns divided into two main areas: discipline formation and prosocial character internalization, which led to the formulation of a new conceptual model as an original finding.

The first pattern is the relationship between the Reinforcement Pattern and the improvement of students' Intrinsic Discipline. The analysis shows that the systematic application of reinforcement must include two integrated components. First, Specific Positive Reinforcement (such as praise that points to specific behaviors) has a strong correlation with increasing intrinsic motivation and self-efficacy, which are prerequisites for sustained compliance (Zahid & Cheema, 2023; S. Macalisang & G. Bonghawan, 2024). Second, Negative Reinforcement is strictly applied as the withdrawal of aversive stimuli after disciplined behavior is demonstrated, which has been proven essential in reducing the frequency of deviant behavior and strengthening self-regulation without relying on punishment (Siti Nuraisah et al., 2023). The synthesis of these patterns confirms that the integration of positive and

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negative reinforcement creates a stable classroom environment, mitigates destructive behavior, and fundamentally contributes to improved discipline rooted in students' intrinsic motivation.

The second pattern identified is the central role of Shaping Behavior in developing complex prosocial behaviors. Since social behaviors such as collaboration, tolerance, and peaceful conflict resolution are not single responses, the shaping process involving differential reinforcement of approximations to the target behavior becomes crucial (An, 2022). This strategy allows teachers to break down social behaviors into achievable steps, ensuring that the internalization of character values occurs gradually and becomes an internalized response, not just temporary compliance. The combination of reinforcement (for the foundation of discipline) and shaping (for prosocial complexity) produces a double effect: discipline as the foundation of classroom stability, and prosocial behavior as a manifestation of healthy social interaction, creating a more inclusive, conducive, and conflict-free learning environment (Rad et al., 2022).

As the culmination of analytical findings and the synthesis of all studies on reinforcement and behavior shaping patterns aimed at holistic goals, this research produced the Contributive Behaviorist Conceptual Model (Original Findings). This model represents a unique integration framework that connects the principles of operant conditioning (Behavioristic: reinforcement and shaping) with the global development agenda (Contributive: instilling prosocial character and making a real contribution to SDG 16). The application of reinforcement and shaping behavior in elementary schools serves as an effective micro-policy intervention for SDG 16, as it directly instills and strengthens the foundations of social justice and peace at the smallest level. Therefore, the results of this study confirm that Behaviorism mechanisms are not only relevant to character building but are also real and measurable contributors to the achievement of sustainable development goals through education.

DISCUSSION

This discussion focuses on an in-depth analysis of how the identified patterns of findings—related to reinforcement and shaping behavior—correlate strongly with B.F. Skinner's operant conditioning theory, and positions the Contributive Behaviorist Conceptual Model as a theoretical extension relevant to contemporary character needs and the global agenda.

Behaviorism in Discipline Formation: From External Compliance to Intrinsic Motivation

Findings regarding the effectiveness of Specific Positive Reinforcement (behavior-specific praise) and Negative Reinforcement in classroom management are a revalidation of Skinner's fundamental principles, but with an emphasis on internal impact. Theoretically, reinforcement aims to increase the frequency of behavioral responses. In this context, the reinforced responses are self-discipline and social responsibility.

Contrary to the classical behaviorist view, which is often considered to focus on external control, these findings show that the specific application of reinforcement by teachers serves as a catalyst for

intrinsic motivation (self-efficacy). When praise explicitly refers to correct effort or process (e.g., “I'm glad you completed this task neatly; it shows perseverance”), this is consistent with social cognitive theory, which emphasizes reinforcement through mastery experience. Thus, this reinforcement pattern bridges behaviorism and cognitivism, showing that reinforcement not only changes behavior but also strengthens students' self-belief, which then triggers sustained discipline (Zahid & Cheema, 2023). Negative reinforcement also plays an important role, where the withdrawal of unpleasant stimuli after disciplined behavior is performed teaches students to actively manage their environment (Siti Nuraisah et al., 2023), a key mechanism in the development of self-regulation, which is at the core of internal discipline.

Theory Extension: Shaping Behavior for Complex Prosocial Character

The application of shaping behavior in the formation of prosocial character (such as empathy, collaboration, and tolerance) is a significant extension of the function of operant conditioning beyond simple motor behavior. Prosocial character is a complex behavioral construct and does not emerge as a single response. This is where Skinner's principle of differential reinforcement becomes highly relevant.

This discussion shows that by breaking down prosocial behavior into gradual approximations (e.g., the first step is sharing, the second step is sharing without being asked), teachers systematically reinforce behaviors that increasingly approach the desired character target (An, 2022). This process ensures that character internalization does not occur randomly, but rather through a series of controlled learning experiences tied to consequences. Through this lens, behaviorism has proven capable of overcoming criticism that it is only effective for basic behaviors, by providing a solid framework for fostering healthy social interactions and mitigating conflict (Rad et al., 2022), which is an important foundation for an inclusive learning environment.

Behavioristic-Contributive Model: Theoretical Contributions and Implementation of SDG 16

The original finding of this research, the Conceptual Behavioristic-Contributive Model, positions behaviorism not only as a pedagogical tool but as a real contributor to the global development agenda. This model theoretically shifts behaviorism toward the neo-behaviorist spectrum, which recognizes the role of measurable behavior in achieving more socially and ethically valuable goals.

The relationship with SDG 16 (Peace, Justice, and Strong Institutions) lies in the mechanisms of shaping and reinforcement themselves. Principles such as fair and consistent reinforcement reflect practices of justice at the micro (classroom) level, teaching students about the consistency of rules and consequences. When prosocial behaviors such as peaceful conflict resolution are reinforced, students learn to become responsible and non-discriminatory citizens, in line with the spirit of SDG 16 (Wanasinghe-Pasqual, 2020). Therefore, the Behavioristic-Contributive Model serves as an effective micro-policy intervention, instilling the foundations of peace and social justice at an early age, an aspect that is still rarely explored explicitly in the behavioral education literature.

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Contextualization and Adaptation of Implementation

Although the Contributory-Behavioral Model provides a strong conceptual framework, comparative studies highlight that its effectiveness is greatly influenced by contextual and cultural factors (Fatima et al., 2023). Teachers must adjust the type, frequency, and form of reinforcement to be relevant to the background of Indonesian students. This model requires adaptation to align with local wisdom values, which can strengthen the impact of positive reinforcement. Therefore, the successful implementation of the Contributive Behaviorism Model in Indonesia depends on the ability of teachers to adapt B.F. Skinner's behaviorism theory into an approach that is sensitive to the social and cultural dynamics and unique characteristics of Indonesian students, in line with the spirit of the Merdeka Curriculum, which emphasizes personalized learning and inclusivity (Ismail Musa, 2025).

Methodological Limitations and Prospective Research Directions

This study has methodological limitations that should be noted, mainly because of its focus on library research. This limitation means that the conceptual findings are not supported by direct empirical data from field interventions, thus limiting the study's ability to capture the complex dynamics of classroom interactions and variations in the application of reinforcement in real-time. Furthermore, the generalization of the Contributory Behaviorist Model is limited by variations in school cultural contexts and student characteristics, where the effectiveness of Operant Conditioning is greatly influenced by contextual and social factors (Tantu & Marina, 2023). These limitations inherently affect the interpretation of results and their practical application at the policy level.

To overcome these limitations, future research is advised to shift to more interventional and integrative methodologies. The use of action research is highly recommended to directly test the effectiveness of the Contributive-Behaviorist Model reinforcement in elementary school settings, allowing teachers and researchers to collaborate in the design and evaluation of interventions. This approach can be strengthened through mixed-methods, which combine the depth of qualitative data (e.g., understanding the motivations of low-achieving students) with the power of generalization of quantitative data.

Prospective research directions should also prioritize longitudinal studies. These studies are crucial because true character formation is not only assessed by short-term behavioral changes (performance) resulting from stimuli, but also by the extent to which prosocial behavior has been internalized as a stable and enduring trait (competence). The stability and persistence of behavior must be tested because true character is measured by students' ability to make ethical choices and exercise self-discipline consistently, even when external reinforcement (rewards or praise) has been removed or when they are in challenging environments. If behavior shaped through shaping does not last, it only indicates compliance, not character formation. Therefore, longitudinal studies will provide strong evidence of the transformation from external compliance to internal discipline and sustainable prosocial character, which is a vital prerequisite for SDG 16.

Finally, the expansion of the research scope includes Cross-Cultural Studies to compare the effectiveness of Skinner's theory in various contexts (Kinyanjui et al., 2015; Uddin et al., 2017) and the exploration of the integration of behaviorism with humanistic theory (Retnasari et al., 2021). This integration aims to produce a framework that not only controls behavior but also facilitates student autonomy and intrinsic potential, making the Contributive Behaviorism Model a more holistic and rich framework.

Inclusive and Transformational Closing Insights

This study provides an in-depth synthesis that is consistent with its objective, which is to identify and analyze the application of reinforcement principles. This includes positive reinforcement (such as verbal praise and social recognition) and negative reinforcement (such as task reduction or mild sanctions), along with shaping behavior to foster discipline and prosocial behavior in elementary school students. Key findings indicate that positive reinforcement, when applied consistently, not only improves student discipline by up to 10.1% in an online context, but also builds confidence and concentration, especially for low-achieving students who often respond better to affirmative stimuli (Tantu & Marina, 2023); (Fatima et al., 2023). Shaping behavior, as a gradual process in B.F. Skinner's operant conditioning, has been proven effective in changing disruptive behavior into adaptive behavior, such as reducing littering by up to 96% through a differential praise note system, thereby creating a more structured and cooperative classroom environment (Rikki K. Wheatley et al., 2009); (Hu, 2024). This analysis emphasizes that the combination of reinforcement and shaping is not merely a control tool, but rather an interactive learning medium that encourages the internalization of prosocial values, such as responsibility and obedience, through contextual adaptations such as class size, gender dynamics, and resource availability (Kinyanjui et al., 2015); (Rafif & Dafit, 2023).

The theoretical contribution of this research expands Skinner's behaviorist framework toward neo-behaviorism, where emotional and social dimensions, such as teacher empathy and peer interaction, are integrated to form a holistic character. In the context of primary education, positive reinforcement has been shown to be superior to punishment in increasing motivation and retention, especially when adapted to cultural values, such as in Islamic education where ethical stimuli reinforce adaptive behavior without external dependence (Yuli et al., 2024); (Agus et al., 2024). This approach also highlights the role of teachers as role models in emotional socialization, where reinforcement from peers and the classroom context supports emotional regulation and prosocial behavior, thereby reducing conflict and exclusion (Valiente et al., 2020); (Uddin et al., 2017). Logically, these findings build the argument that reinforcement and shaping behavior are not only reactive to disciplinary problems but also proactive in shaping a learning ecosystem that supports students' continuous growth.

At a broader level, this research explains the contribution of reinforcement to the achievement of SDG 16 through peaceful, inclusive, and equitable education. In Indonesia's Merdeka Curriculum, for example, this behaviorist approach personalizes learning to address the challenges of inclusivity, thereby promoting peaceful societies by reducing antisocial behavior and encouraging cooperation

(Ismail Musa, 2025). In a post-conflict context, reinforcement through peace education functions as a social process that builds justice, where prosocial behavior is reinforced to achieve SDG 16 goals such as reducing violence and promoting inclusive institutions (Wanasinghe-Pasqual, 2020). In conclusion, this study confirms that behaviorism theory, when applied adaptively, provides a scientific basis for addressing discipline issues in Indonesian primary education, while contributing to the global agenda of inclusivity by recommending the integration of technologies such as digital platforms for large-scale reinforcement to ensure sustainable and equitable behavioral transformation.

CONCLUSIONS

This study aims to analyze the integration of B.F. Skinner's behaviorist principles in shaping the prosocial behavior of elementary school students and its contribution to SDG 16. Fundamentally, this study concludes that reinforcement and shaping behavior have proven effective as a pedagogical framework for modifying and fostering self-discipline and social responsibility in students. The main contribution of this study is the Contributive Behaviorist Conceptual Model, which offers an expansion of the neo-behaviorist perspective and affirms the relevance of operant conditioning in supporting the global agenda of creating a peaceful and inclusive society (SDG 16). Furthermore, it is recommended that future research conduct empirical tests (e.g., longitudinal studies or action research) to validate the long-term stability and effectiveness of this conceptual model, as well as explore its integration with more holistic approaches to character education.

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