JKTP: Jurnal Kajian Teknologi Pendidikan
Vol. 9, No. 4, November 2026: 486-498
e-ISSN: 2615-8787
DOI: 10.17977/um038v9i42026p486-498
https://journal-fip.um.ac.id/index.php/jktp

INTEGRATING BEHAVIORIST PRINCIPLES INTO ADAPTIVE INSTRUCTIONAL DESIGN BASED ON STUDENT CHARACTERISTICS: A LITERATURE REVIEW

I Wayan Widya Wedana, Rangga Firdaus
Program Studi Teknologi Pendidikan, Fakultas Ilmu Pendidikan, Universitas Lampung
Corresponding Author E-Mail: iwayanwidyawedana@gmail.com

Article History
Received: 24 October 2026, Accepted: 04 November 2026, ***Published: 11 November 2026***

Abstrak
Desain instruksional pada pendidikan jarak jauh sulit mengakomodasi keragaman karakteristik Siswa, seperti modalitas kognitif, kecepatan pemrosesan, dan kemandirian belajar. Pendekatan behavioristik yang dapat menyediakan struktur belajar terukur kerap dinilai kaku, sehingga integrasinya dengan karakteristik siswa belum banyak diuraikan. Kajian ini menelaah penerapan prinsip behavioristik adaptif dalam desain pembelajaran yang berpusat pada keragaman siswa melalui tinjauan literatur sistematis berpedoman PRISMA terhadap artikel bereputasi yang terbit dalam kurun delapan tahun terakhir. Data dianalisis menggunakan analisis tematik melalui pengodean, pengelompokan tema, dan sintesis naratif. Hasil kajian mengidentifikasi lima prinsip behavioristik, yaitu penguatan, umpan balik, pengulangan terstruktur, penahapan materi, dan tujuan perilaku terukur. Kelima prinsip tersebut tidak diterapkan secara seragam, melainkan diintegrasikan melalui siklus asesmen diagnostik, diferensiasi stimulus, dan otomasi umpan balik yang bergerak sepanjang taksonomi perilaku lima tingkat. Integrasi ini menunjukkan bahwa behaviorisme dapat berfungsi sebagai lapisan struktural yang memperkuat pembelajaran berpusat pada siswa, dengan efektivitas yang bersifat kondisional dan memerlukan pengurangan penguatan secara bertahap agar mendukung regulasi diri. Kajian ini merumuskan Framework Desain Behavioristik Berdiferensiasi sebagai acuan perancangan pembelajaran yang inklusif, dan pengujian empiris pada penelitian lanjutan masih diperlukan.

Kata Kunci: Pendekatan Behavioristik; Desain Pembelajaran; Karakteristik Siswa; Pembelajaran Adaptif; Tinjauan Literatur

Abstract
Instructional design in distance education struggles to accommodate the diversity of learner characteristics, such as cognitive modalities, processing speed, and self-directed learning. Behaviorist approaches, which can provide a measurable learning structure, are often perceived as rigid; consequently, their integration with learner characteristics has not been extensively explored. This study examines the application of adaptive behaviorist principles in learner-centered instructional design through a systematic literature review guided by the PRISMA analysis of reputable articles published over the past eight years. PRISMA analysis of reputable articles published over the past eight years.Data were analyzed using thematic analysis through coding, theme clustering, and narrative synthesis. The findings identified five behaviorist principles: reinforcement, feedback, structured repetition, material sequencing, and measurable behavioral objectives. These five principles were not applied uniformly but were integrated through a cycle of diagnostic assessment, stimulus differentiation, and automated feedback that progresses across the five-level behavioral taxonomy. This integration demonstrates that behaviorism can function as a structural layer that reinforces student-centered learning, with effectiveness that is conditional and requires gradual reduction of reinforcement to support self-regulation. This study formulates the Differentiated Behaviorist Design Framework as a guideline for inclusive instructional design, and empirical testing in follow-up research is still needed.

Keywords*: Behaviorist Approach; Instructional Design; Student Characteristics; Adaptive Learning; Literature Review*

To cite this article:
Wedana, I. W. W, & Firdaus, R. (2026). Integrating behaviorist principles into adaptive instructional design based on student characteristics: A literature review. *JKTP: Jurnal Kajian Teknologi Pendidikan*, *9*(4), 486–498. doi: 10.17977/um038v9i42026p486-498

INTRODUCTION

The current global educational paradigm positions a comprehensive understanding of student heterogeneity, encompassing cognitive modalities, information processing speed, and learning autonomy, as an essential foundation for achieving equitable learning effectiveness (Bucheli et al., 2024). In instructional design, the principles of structured practice, reinforcement, and mastery can support the development of procedural skills and knowledge retention. Empirical evidence indicates that systematically designed practice can strengthen retention, although successful knowledge recall does not necessarily guarantee the ability to apply that knowledge (Brodsky & Fienup, 2018; Ophuis-cox et al., 2026).

The advantages of behaviorist principles have gained renewed relevance amid digital transformation, as learning platforms enable the delivery of automated and timely feedback, as well as the monitoring of student responses through learning analytics. This integration creates opportunities to implement structured practice and reinforcement mechanisms in digital learning environments (Cavalcanti et al., 2021; Hong et al., 2024; Kazem et al., 2022). When combined with student characteristic profiling, behaviorist principles provide a predictive and measurable instructional architecture, enabling educators to create adaptive learning environments that consistently stimulate active student engagement across various instructional contexts (Plooy et al., 2024).

Despite its contribution to explaining learning through observable behavior, the behaviorist approach is frequently criticized for being insufficient to explain cognitive processes and the complexity of learning experiences. This criticism becomes more pronounced when behaviorism is narrowly understood as a mechanistic approach, whereas its application in education encompasses various forms and theoretical developments (Abramson, 2013; Wrigley, 2019). Studies on differentiated instruction have largely associated instructional adjustments with student-centered philosophies, including humanism and constructivism (Kerimbayev et al., 2023). On the other hand, adaptations based on individual characteristics also create opportunities to develop behaviorist principles adaptively, for instance, by adjusting practice sequences, forms of reinforcement, and feedback according to students' learning responses (Fitriyah & Bisri, 2023; Hasrinah & Ismail, 2025).

Nevertheless, the integration of behaviorist principles into adaptive learning still presents several theoretical and methodological gaps. Fitriyah and Bisri (2023) noted that adaptations based on individual characteristics create opportunities for the adaptive development of behaviorist principles, but their study did not elaborate on how specific student characteristics guide design decisions or the taxonomy of implementation stages. A similar limitation can be observed in the study by Hasrinah and Ismail (2025) on the adjustment of practice sequences and adaptive feedback, which did not provide a cross-contextual framework or structured transition mechanisms between mastery levels.

Similar gaps are also evident in studies integrating modern technologies. Kerimbayev et al. (2023) explored personalization in student-centered distance learning but did not explicitly establish behaviorism as its theoretical foundation or elaborate on the relationship between student characteristics and adaptation theories. Meanwhile, Wang et al. (2025) examined a data-driven adaptive learning model without explicitly identifying behavioral theory as its underlying foundation. More recently, the innovation of artificial intelligence-based intelligent tutoring systems by Deutscher et al. (2026) has enabled real-time reinforcement and feedback. However, its development has remained focused primarily on technical effectiveness and has yet to integrate student profile mapping and fading mechanisms comprehensively.

A mapping of key studies published over the last three years reveals three limitations in the existing body of knowledge. First, adaptive and personalized learning research has developed rapidly and increasingly relies on technology (Kerimbayev et al., 2023; Wang et al., 2025), yet the behavioral theoretical foundations underlying adaptation decisions are rarely made explicit. Second, studies implementing reinforcement principles and adaptive feedback, including those using intelligent tutoring systems (Deutscher et al., 2026; Hasrinah & Ismail, 2025), have focused more on technical effectiveness and have not explained how student profiles determine instructional stages, forms of reinforcement, and criteria for progression between levels. Third, the consequences of this separation are evident in practice, where the adoption of behaviorism is distorted into superficial transactional behavior modification without adequate assessment of individual characteristics (Nesselrode et al., 2022). Thus, the relationship between student characteristics and theoretical foundations in designing adaptive learning has not been adequately explained, particularly in open and distance education contexts. This gap is addressed in the present review through the formulation of a conceptual framework that integrates operant conditioning principles, graduated stimulus design, and student characteristic profiling.

Addressing this conceptual gap is urgent because failure to reconceptualize modern behaviorism may leave instructional designers without precise instruments for measuring learning behavior amid the growing demand for personalized education (Kerimbayev et al., 2023). Accordingly, this literature review proposes a conceptual contribution in the form of a Differentiated Behaviorist Design Framework, which combines the precision of stimulus–response architecture with instruments for differentiating student learning profiles (Kucirkova et al., 2021; Plooy et al., 2024). This review aims to critically synthesize how behaviorist principles can be integrated adaptively to accommodate diverse student characteristics. To achieve this objective, the review addresses three research questions: RQ1. Which behaviorist principles have been applied in instructional design, and how have they been implemented in the literature published between 2019 and 2026? RQ2. How are these principles associated with diverse student characteristics through diagnostic assessment and instructional differentiation? RQ3. How can these integration patterns be formulated into a conceptual framework, including transitions between behavioral levels, and what are their theoretical limitations when examined through the perspectives of Cognitive Load Theory, constructivism, and Self-Regulated Learning?

METHOD

This study employed a qualitative approach with a systematic literature review design, conducted and reported in accordance with the PRISMA 2020 guidelines (Page et al., 2021). The review examined articles published in reputable journals between 2019 and 2026 addressing behaviorist approaches, instructional design, and diverse student characteristics. Searches were conducted in the Scopus, ERIC, and Google Scholar databases on [search date]. Keywords were formulated using Boolean operators across three concept groups connected by AND, as follows: (“behaviorist*” OR “behaviourist*” OR “operant conditioning” OR “behavio* learning” OR “reinforcement”) AND (“instructional design” OR “learning design” OR “lesson design” OR “teaching strategy”) AND (“student diversity” OR “diverse learners” OR “learner characteristics” OR “individual differences” OR “inclusive education”). The search string was applied to titles, abstracts, and keywords (TITLE-ABS-KEY), with restrictions to publications from 2019 to 2026, article document types, and English-language publications. It was also adapted to the search syntax of the other databases.

The inclusion criteria comprised peer-reviewed journal articles published between 2019 and 2026, written in English or Indonesian, available in full text, addressing behaviorist approaches to learning, examining instructional design or instructional strategies, and relating these approaches to

diverse student characteristics, such as learning styles, abilities, backgrounds, or special needs. The exclusion criteria comprised publications outside the specified period; conference proceedings, books, reports, undergraduate theses, master's theses, and preprints; articles whose full texts were inaccessible; articles that mentioned behaviorism only in passing without substantive discussion; and articles that did not relate their discussion to diverse student characteristics.

Article selection was conducted through the four PRISMA stages (Figure 1). During the identification stage, searches in Scopus (n = 28), ERIC (n = 12), and Google Scholar (n = 10) yielded 50 records. After six duplicates were removed using [Mendeley/Zotero], 44 records remained. During the screening stage, the titles and abstracts of all 44 records were reviewed, and 18 records were excluded as irrelevant, leaving 26 articles for the next stage. During the eligibility stage, the full texts of all 26 articles were assessed against the inclusion and exclusion criteria. A total of 14 articles were excluded: two because their full texts were inaccessible (E3), six because behaviorism was not discussed substantively (E4), and six because their discussion was not related to diverse student characteristics (E5). At the inclusion stage, 12 articles met all the criteria and were subjected to further analysis. The selection process was conducted by [two independent researchers], and any disagreements were resolved through discussion until consensus was reached.

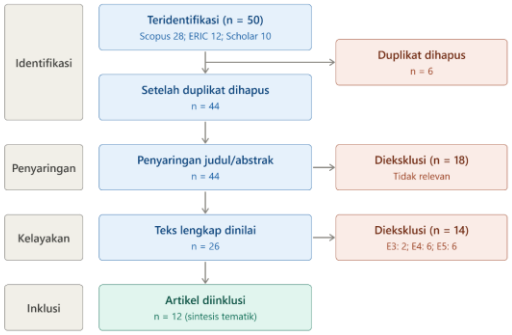


Figure 1. PRISMA Flowchart

The research instruments consisted of a selection protocol and a data extraction matrix. The selection protocol specified the inclusion and exclusion criteria outlined above, while the extraction matrix recorded article details (authors, year, and journal), research objectives, context and participants, behaviorist principles applied, instructional design approaches, student characteristics examined, and key findings. The extracted data were analyzed thematically through three steps: inductive data coding, grouping codes into themes, and narrative synthesis to identify patterns in the integration of behaviorist approaches with diverse student characteristics.

RESULTS

The synthesis of the 12 articles revealed three main findings. First, attention to student diversity was most commonly reflected in the principles of reinforcement and feedback. These principles were each identified in three of the 12 articles, while structured repetition, content sequencing, and measurable behavioral objectives were each identified in two articles. Second, behaviorist approaches were no longer implemented through uniform drill-based exercises. Instead, their application shifted toward a data-driven differentiation framework. This shift was evident in the use of AI-based Intelligent Tutoring Systems, diagnostic assessments, and student profile mapping. Third, the student diversity examined primarily concerned ability levels, ranging from students requiring intervention to gifted students. Other dimensions, including learning styles, residential areas, and ethnic backgrounds, received comparatively limited attention. The five behaviorist principles and their respective forms of implementation are summarized in Table 1.

Table 1. Synthesis of Behaviorist Principles, Instructional Design Strategies, and Student Characteristics Accommodated

Behaviorist Principle	Learning Design Strategy	Student Characteristics Accommodated	Integration Pattern	Sources
Reinforcement	AI-based Intelligent Tutoring Systems provide real-time reinforcement in the form of scores, verbal praise, badges, and points to reinforce appropriate learning behaviors and support scaffolding in solving complex vocational problems.	Differences in age, background, and learning experiences give rise to varying motivational needs, particularly among students who rely on periodic feedback and rewards to maintain engagement.	Digital platforms automate reinforcement through adaptive feedback tailored to individual learning paces and achievements to strengthen retention and desired learning behaviors.	(Anindita & Afina, 2025; Deutscher et al., 2026; Sudiar, 2026)
Feedback	Classroom observation serves as a formative assessment that provides immediate feedback to students and a basis for teachers to adjust instruction.	Monitoring learning difficulties and progress identifies the needs of students requiring additional intervention as well as advanced and gifted learners.	Formative assessment through observation and portfolios generates feedback for teacher reflection and instructional adjustments based on student needs.	(Ardenli d et al., 2025; Komara et al., 2025; S, 2023)
Structured Repetition	Mastery learning facilitates repeated exposure to learning materials until mastery is achieved, reflecting the principles of continuous application and simple instructional strategies.	This approach addresses differences in student abilities, ranging from those requiring repeated practice to priority groups at intermediate and higher proficiency levels.	Mastery learning is systematically implemented for students with diverse abilities through strategic grouping, focused targeting, and integrated adaptation.	(Sedanza & Abatayo, 2026; Smale-jacobse et al., 2019)
Shaping and Sequencing	Initial diagnostic assessment and strategic grouping provide the basis for differentiated instruction through tiered tasks, scaffolds, and adaptive materials to optimize the potential of high-achieving students in heterogeneous classrooms.	Instruction maps two ends of the student readiness spectrum: groups with different levels of prior understanding (those who have not yet mastered and those who have already mastered the material) and high-achieving students who require challenging tasks and enrichment.	Differentiated Instruction combines flexible classroom management with ability-based student grouping to adapt instructional materials, ensuring targeted interventions without bias arising from expectations.	(Ariandini & Hidayati, 2023; Ziernwald et al., 2022)
Behavioral Objectives	Learning objectives are designed to be measurable and operational and aligned with the results of student characteristic analyses, enabling more effective differentiated instruction and objective evaluation.	Student profiles are mapped based on learning style modalities (visual, auditory, kinesthetic, or multimodal), sociogeographical residential factors (urban/rural), and ethnic backgrounds (such as Javanese, Sundanese, and Cirebonese), facilitating systematic measurement of changes in children's behavior.	Instruction is designed around these characteristics so that instructional strategies and objectives can be measured periodically. The results are subsequently used as a basis for instructional evaluation and the development of reinforcement-based strategies.	(Gustrianto & Herawan, 2025; Ningtyas et al., 2026)

Under the reinforcement principle, scores, verbal praise, badges, and points are delivered adaptively and in real time through AI-based Intelligent Tutoring Systems (Anindita & Afina, 2025; Deutscher et al., 2026; Sudiar, 2026). Under the feedback principle, classroom observations and portfolios serve as formative assessments to distinguish students requiring additional intervention from advanced and gifted students (Ardenlid et al., 2025; Komara et al., 2025; S, 2023). The principle of structured repetition is reflected in mastery learning, in which instruction is repeated until competency is achieved (Sedanza & Abatayo, 2026; Smale-Jacobse et al., 2019). The principle of content sequencing is implemented through initial diagnostic assessments, strategic grouping, tiered tasks, scaffolds, and adaptive instructional materials (Ariandini & Hidayati, 2023; Ziernwald et al., 2022). Meanwhile, measurable behavioral objectives are formulated based on student profile mapping according to learning styles, residential areas, and ethnic backgrounds (Gustrianto & Herawan, 2025; Ningtyas et al., 2026).



Figure 2. Conceptual Framework for Integrating Behaviorist Approaches into Instructional Design Centered on Student Diversity

Figure 2 illustrates a cycle of three components surrounding a five-level behavioral taxonomy. Diagnostic assessment determines students' starting points based on behavioral baselines, needs, and learning styles (Ariandini & Hidayati, 2023; Gustrianto & Herawan, 2025). Stimulus differentiation adjusts content, scaffolding, and the learning environment (Ziernwald et al., 2022). Feedback automation provides reinforcement and real-time progress tracking (Anindita & Afina, 2025; Deutscher et al., 2026). The resulting data are fed back into the assessment process, ensuring that progression between levels is determined by achievement criteria rather than duration (Sedanza & Abatayo, 2026; Smale-Jacobse et al., 2019).

Control gradually shifts from the teacher to the student. Level 1 (baseline/reactive response) establishes basic responses through reinforcement. Level 2 (guided/prompted response) provides gradual scaffolding to reduce cognitive load (Sweller et al., 1998), which is subsequently withdrawn at the appropriate time (Tetzlaff et al., 2025). Level 3 (discriminative performance) requires students to select appropriate responses. Level 4 (self-regulated behavior) represents a turning point: external rewards are provided less frequently and replaced with process-oriented feedback (Deci et al., 1999; Liao et al., 2023), while students begin setting their own goals (Zimmerman, 2002). Level 5 (adaptive/novel behavior) assesses the application of strategies in new contexts (Sinha & Kapur, 2021).

The progression is non-linear: students may move down or advance directly to higher levels based on diagnostic assessment results (Ardenlid et al., 2025; Komara et al., 2025). Levels 4–5 represent a conceptual extension, as the literature primarily documents Levels 1–3.

DISCUSSION

The main findings of this review indicate that behaviorist principles are not applied uniformly but are instead linked to student profiles through diagnostic assessment (Herliana et al., 2024). This finding supports the argument that criticism of behaviorism as a mechanistic approach applies only when the approach is understood narrowly, whereas its application in education encompasses various forms and theoretical developments (Abramson, 2013; Wrigley, 2019). This review also aligns with studies that position adaptations based on individual characteristics as an opportunity to develop behaviorist principles adaptively, for instance, by adjusting practice sequences, forms of reinforcement, and feedback (Fitriyah & Bisri, 2023; Hasrinah & Ismail, 2025). These findings also explain why practices in the field often produce disappointing results. When individual characteristics are not assessed prior to implementation, behaviorism becomes distorted into superficial transactional behavior modification (Nesselrode et al., 2022). The problem, therefore, does not lie in the principle of reinforcement itself, but in the absence of a mechanism connecting that principle to student-related data. This review complements existing discussions on student-centered learning and adaptive technologies (Kerimbayev et al., 2023) by explicitly identifying the behavioral foundations that have rarely informed adaptation decisions.

Diagnostic assessment determines students' starting points and the scale of their learning progression, allowing reinforcement contingencies to be calibrated according to individual achievements. Real-time reinforcement delivered by intelligent tutoring systems and formative feedback provided by teachers accommodate each student's learning pace and achievements, thereby addressing the limitations of uniform instructional design (Brummer et al., 2024). Mastery learning and tiered tasks enable students with different levels of readiness to work toward the same objectives from their respective starting points. Repeated successful experiences with achievable tasks strengthen students' self-confidence, while teachers' data-informed decisions reduce expectation bias (Bijl et al., 2025). Measurable behavioral objectives provide a basis for objective evaluation, ensuring that personalization remains accountable and can be assessed periodically (Schildkamp et al., 2020). Within the framework presented in Figure 2, these achievement criteria drive students' progression between behavioral taxonomy levels. Progression is determined by mastery rather than duration, allowing students who have not yet met the criteria to return to the preceding level, while advanced learners can be placed at higher levels from the outset.

Content sequencing and scaffolding are consistent with Cognitive Load Theory (CLT), as small, gradual steps reduce intrinsic cognitive load for novice learners (Sweller, 1988). This alignment is important because it demonstrates that the initial levels of the taxonomy (basic and guided responses) have a cognitive rationale, not merely a behaviorist one. However, CLT also offers a caution. According to the expertise reversal effect, support that benefits novice learners may become redundant and impose additional cognitive demands on more advanced learners (Tetzlaff et al., 2025). Therefore, diagnostic-based differentiation is not merely an additional feature but a prerequisite for ensuring that behaviorist structures do not disadvantage advanced learners. This is consistent with studies examining gifted students, which emphasize the identification of individual needs before intervention (Ardenlid et al., 2025; Komara et al., 2025). The implication is that progression criteria within the framework serve not merely as assessment instruments but also as regulators of cognitive load: withdrawing support too late can make it burdensome, whereas withdrawing it too early can overwhelm students. Gamification elements such as badges and points may also increase extraneous cognitive load if students' attention is divided between learning tasks and rewards; therefore, their effects require empirical examination.

The classification of scaffolding and tiered tasks as behaviorist practices warrants debate, since the concept of scaffolding originates from sociocultural and constructivist traditions (Vygotsky, 1978; Wood et al., 1976). The findings of this review therefore do not establish that behaviorism alone is responsible for the observed outcomes. Rather, they reveal a form of hybridization in which behaviorist structures and reinforcement are combined with constructivist support. Interestingly, the original formulation of scaffolding already incorporated the idea of gradually withdrawing assistance as students' competence increases (Wood et al., 1976). This suggests that the points of convergence between the two traditions are closer than commonly assumed, and that fading can serve as a conceptual bridge between them. Contrasting studies further reinforce the need for caution. Research on productive failure demonstrates that allowing students to struggle with problems before receiving instruction can lead to better knowledge transfer (Sinha & Kapur, 2021). This finding contrasts with the logic of sequencing that seeks to minimize errors from the outset. The debate between guided instruction and problem-based learning also remains unresolved (Hmelo-Silver et al., 2007; Kirschner et al., 2010). Accordingly, the findings of this review are conditional: behaviorist structures are effective for mastering basic competencies, whereas goals involving transfer and deep conceptual understanding require an exploratory phase. Within the framework in Figure 2, this exploratory phase is most appropriately positioned at Level 5, after students have established a sufficient foundation.

The framework in Figure 2 positions structured instruction as the foundation for the development of self-regulation. This proposition faces a tension with Self-Regulated Learning (SRL) theory. In Zimmerman's (2002) model, self-regulated learners independently set goals, monitor their performance, and reflect on their outcomes, whereas external reinforcement places control in the hands of others. Meta-analytic evidence indicates that expected tangible rewards can undermine intrinsic motivation (Deci et al., 1999), suggesting that points and badges may shift students' orientation from mastering learning materials to pursuing rewards.

Feedback quality is a determining factor in whether instructional structures facilitate or hinder self-regulation. Informative feedback does not merely indicate the correctness of students' work; it also explains the processes and strategies they can use to improve their performance. The meta-analysis by Brummer et al. (2024) indicates that feedback focus, including its orientation toward learning processes, contributes to variations in the effectiveness of digital feedback. Similarly, Cai et al. (2023) found that explanatory feedback had the strongest influence on academic achievement compared with other forms of feedback. Alfiansyah et al. (2022) and Liao et al. (2023) emphasize that human feedback mechanisms need to account for student autonomy and avoid excessive dependence on technology. These findings challenge the forms of reinforcement most frequently identified in the analyzed articles, namely scores, verbal praise, badges, and points. Such forms are effective in establishing basic responses at the initial levels but are insufficient to promote self-regulation at Level 4. Therefore, reinforcement in adaptive instructional design should not focus solely on providing responses to behavior but should also offer information that helps students understand errors, improve their strategies, and regulate their learning processes (Halimah et al., 2024). Thus, behaviorist structures can serve as a foundation for SRL only when external rewards are gradually reduced as competence increases and control over reinforcement shifts from the teacher or system to the student. Without such a mechanism, structured instruction may foster dependence rather than autonomy.

Theoretically, this review proposes repositioning behaviorism as a structural layer within a multilayered learning model rather than as a standalone theory competing with constructivism or SRL. This layer provides contingencies, sequencing, and achievement measures, while the constructivist and SRL layers contribute meaning, transfer, and autonomy. Fading needs to be

explicitly incorporated as the link between these two layers because this is where the theoretical tension becomes most apparent. In practical terms, four implications can be identified. First, diagnostic assessment needs to account for students' ability levels to prevent support from becoming redundant for advanced learners. Second, external reinforcement should be designed to decrease as competence increases and be replaced with process-oriented feedback. Third, mastery learning should be combined with tasks that allow students to struggle with problems before receiving full guidance when the intended outcome is knowledge transfer. Fourth, teachers need training in interpreting diagnostic data and selecting appropriate types of feedback, including when using intelligent tutoring systems.

This review examined 12 articles representing diverse contexts, educational levels, and research designs; therefore, its synthesis is conceptual in nature and cannot be statistically generalized. Further research should empirically examine the effects of reinforcement fading on self-regulation and the interaction between student ability levels and types of instructional support.

CONCLUSION

This review concludes that behaviorism and differentiation are not opposing approaches but operate at different levels: behaviorism addresses how learning behaviors are shaped and measured, whereas differentiation determines for whom and from what starting point this process begins. Structures calibrated to student profiles and gradually withdrawn can serve as prerequisites for the development of learner autonomy. However, their effectiveness is conditional and depends on the accuracy of diagnostic assessment, the quality of process-oriented feedback, and fading mechanisms that transfer control over reinforcement to students. Theoretically, behaviorism is more appropriately positioned as a structural layer within a multilayered learning model alongside constructivism and Self-Regulated Learning. In practical terms, instructional designers need to map students' initial abilities, establish achievement-based progression criteria, and schedule the gradual reduction of external rewards. This review has several limitations, including the limited number of articles (12) representing diverse contexts, the restriction of the search to three databases, the absence of formal article quality assessment, and the fact that Levels 4–5 of the proposed framework remain conceptual extensions. Further research could test this framework through quasi-experimental studies in distance learning contexts, comparing uniform instruction, differentiation without fading, and differentiation with fading, using learning achievement, self-regulation, and intrinsic motivation as outcome variables. Such studies could also analyze the interaction between initial ability levels and types of instructional support to examine the expertise reversal effect.

REFERENCES

Abramson, C. I. (2013). Problems of Teaching the Behaviorist Perspective in the Cognitive Revolution. *Behavioral Sciences*, *3*, 55–71. https://doi.org/10.3390/bs3010055

Alfiansyah, M. F., Adi, E. P., & Soepriyanto, Y. (2022). Pengembangan Multimedia Interaktif IPA dengan Fitur Feedback untuk Siswa Kelas VII. *JKTP: Jurnal Kajian Teknologi Pendidikan*, *5*(1), 22–31. https://doi.org/10.17977/um038v5i12022p022

Anindita, G. K., & Afina, K. N. (2025). Analisis teori behaviorisme john b. watson dan implikasinya dalam konteks teknologi pendidikan. *Golden Childhood Education Journa*, *6*(1). https://doi.org/10.55719/gcej.v6i1.1703

Ardenlid, F., Lundqvist, J., & Sund, L. (2025). International Journal of Educational Research Open A scoping review and thematic analysis of differentiated instruction practices : How teachers foster inclusive classrooms for all students , including gifted students. *International Journal of Educational Research Open*, *8*. https://doi.org/10.1016/j.ijedro.2025.100439

Ariandini, N., & Hidayati, A. (2023). Pembelajaran Adaptif dalam Kurikulum Merdeka : Integrasi Teori Behavioristik , Kognitif , dan Konstruktivis dalam Teknologi Pendidikan. *Jurnal Kependidikan Media*, *12*(3), 158–164. https://doi.org/10.26618/jkm.v12i3.13351

Bijl, R. A., Bergh, L. Van Den, & Bakx, A. W. E. A. (2025). Professional development targeting teacher expectations and behavior to impact (un)equal opportunities : A systematic review. *International Journal of Educational Research Open*, *9*. https://doi.org/10.1016/j.ijedro.2025.100483

Brodsky, J., & Fienup, D. M. (2018). Sidman Goes to College : A Meta-Analysis of Equivalence-Based Instruction in Higher Education. *Perspect Behav Sci*, *41*, 95–119. https://doi.org/10.1007/s40614-018-0150-0

Brummer, L., Boer, H. De, Mouw, J. M., & Strijbos, J. (2024). A meta - analysis of the effects of context , content , and task factors of digitally delivered instructional feedback on learning performance. *Learning Environments Research*, *27*, 453–476. https://doi.org/10.1007/s10984-024-09501-4

Bucheli, M. G. V., Gómez-Galán, J., Mesa, M. L. C., & Catalán, L. L. (2024). Digital technologies as enablers of universal design for learning : higher education students ' perceptions in the context of SDG4. *Discover Sustainability*, *5*(473). https://doi.org/10.1007/s43621-024-00699-0

Cai, Z., Gui, Y., Mao, P., Wang, Z., Hao, X., Fan, X., & Tai, R. H. (2023). The effect of feedback on academic achievement in technology-rich learning environments (TREs): A meta-analytic review. *Educational Research Review*, *39*. https://doi.org/10.1016/j.edurev.2023.100521

Cavalcanti, A. P., Barbosa, A., Carvalho, R., Freitas, F., Tsai, Y.-S., Gasevic, D., & Mello, R. F. (2021). *Computers and Education : Artificial Intelligence Automatic feedback in online learning environments : A systematic literature review*. *2*. https://doi.org/10.1016/j.caeai.2021.100027

Deci, E. L., Koestner, R., & Ryan, R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin*, *125*(6), 627–700. https://doi.org/10.1037/0033-2909.125.6.627

Deutscher, V., Thomann, H., Zlatkin-troitschanskaia, O., Weyland, U., Abele, S., Danek, A. H., Greiff, S., Rausch, A., Seeber, S., Seifried, J., & Winther, E. (2026). Computers and Education : Artificial Intelligence Artificial intelligence in vocational education and training : A systematic review of educational purposes , theoretical conceptualizations , and empirical effectiveness. *Computers and Education: Artificial Intelligence*, *11*. https://doi.org/10.1016/j.caeai.2026.100628

Fitriyah, & Bisri, M. (2023). Pembelajaran Berdiferensiasi Berdasarkan Keragaman dan Keunikan Siswa Sekolah Dasar. *Jurnal Review Pendidikan Dasar: Jurnal Kajian Pendidikan Dan Hasil Penelitian*, *9*(2). https://doi.org/10.26740/jrpd.v9n2.p67-73

Gustrianto, A., & Herawan, E. (2025). Identifikasi Karakteristik Peserta Didik Untuk Menciptakan Pembelajaran Berdiferensiasi di Kelas 4B SDN Kanggraksan Kota Cirebon. *Pendas : Jurnal Ilmiah Pendidikan Dasar*, *10*(2). https://doi.org/10.23969/jp.v10i02.24726

Halimah, N., Duananda, M., Degeng, K., & Soepriyanto, Y. (2024). Peranan Tingkat Penerimaan Learning Management System Terhadap Kemampuan Self Regulated Learning. *JKTP: Jurnal*

Kajian Teknologi Pendidikan, *7*(3), 118–128. https://doi.org/10.17977/um038v7i32024p118

Hasrinah, & Ismail. (2025). Filosofis Pembelajaran Personalisasi (Pembelajaran Diferensiasi) Dalam Konteks Implementasi Kurikulum Merdeka Di Indonesia. *Pendas : Jurnal Ilmiah Pendidikan Dasar*, *10*(4).

Herliana, F., Hafinda, T., & Firmayanto, R. (2024). Differentiated Instruction through Adaptive Learning Platform in Science Education: A Systematic Literature Review Fitria. *Jurnal Pendidikan MIPA*, *25*(2), 914–931. https://doi.org/10.23960/jpmipa/v25i2.pp914-931

Hmelo-silver, C. E., Duncan, R. G., & Chinn, C. A. (2007). Scaffolding and Achievement in Problem-Based and Inquiry Learning : A Response to Kirschner , Sweller , and Clark (2006). *Educational Psychologist*, *42*(2), 99–107. https://doi.org/10.1207/s15326985ep4102_1

Hong, Y., Saab, N., & Admiraal, W. (2024). Computers & Education Approaches and game elements used to tailor digital gamification for learning : A systematic literature review. *Computers & Education*, *212*, 105000. https://doi.org/10.1016/j.compedu.2024.105000

Kazem, S., Noroozi, O., & Ginkel, S. Van. (2022). A systematic review of the role of learning analytics in enhancing feedback practices in higher education. *Educational Research Review*, *37*. https://doi.org/10.1016/j.edurev.2022.100489

Kerimbayev, N., Umirzakova, Z., Shadiev, R., & Jotsov, V. (2023). A student - centered approach using modern technologies in distance learning : a systematic review of the literature. *Smart Learning Environments*, *10*(61). https://doi.org/10.1186/s40561-023-00280-8

Kirschner, P. A., Sweller, J., Clark, R. E., Kirschner, P. A., Sweller, J., Clark, R. E., Minimal, W., Kirschner, P. A., & Clark, R. E. (2010). Why Minimal Guidance During Instruction Does Not Work : An Analysis of the Failure of Experiential , and Inquiry-Based Teaching. *Educational Psychologist*, *41*(2), 75–86. https://doi.org/10.1207/s15326985ep4102

Komara, I. B., Heryani, R., & Murron, F. S. (2025). Pemanfaatan Umoan Balik Dalam Pembelajaran Terdiferensiasi Di Fase C Sekolah Dasar. *Pendas : Jurnal Ilmiah Pendidikan Dasar*, *10*(3). https://doi.org/10.23969/jp.v10i03.29879

Kucirkova, N., Gerard, L., & Linn, M. C. (2021). Designing personalised instruction : A research and design framework. *British Journal of Educational Technology*, *52*, 1839–1861. https://doi.org/10.1111/bjet.13119

Liao, M., Zhu, K., & Wang, G. (2023). Can human-machine feedback in a smart learning environment enhance learners' learning performance? A meta-analysis. *Frontiers in Psychology*, *14*. https://doi.org/10.3389/fpsyg.2023.1288503

Nesselrode, R., Falcomata, T. S., Hills, L., & Erhard, P. (2022). Functional Analysis in Public School Settings : A Systematic Review of the Literature. *Behavior Analysis in Practice*, *15*, 958–970. https://doi.org/10.1007/s40617-022-00679-8

Ningtyas, R. R., Afandi, T., & Ani. (2026). Teori Behaviorisme dalam Psikologi Belajar : Analisis Konseptual dan Implikasinya Terhadap Pembelajaran Anak Sekolah Dasar. *Jurnal Penelitian Dan Penalaran*, *13*(1), 92–106. https://doi.org/10.26618/gbvzrn79

Ophuis-cox, F. H. A., Catrysse, L., & Camp, G. (2026). Mixed effects of retrieval practice on the acquisition of procedural knowledge in verb spelling education. *Learning and Instruction*, *104*. https://doi.org/10.1016/j.learninstruc.2026.102377

Page, M. J., Mckenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-wilson, E., Mcdonald, S., … Moher, D. (2021). The PRISMA 2020 statement : an updated guideline for reporting systematic reviews. *BMJ*, *327*. https://doi.org/10.1136/bmj.n71

Plooy, E. du, Casteleijn, D., & Franzsen, D. (2024). Personalized adaptive learning in higher education : A scoping review of key characteristics and impact on academic performance and engagement. *Heliyon*, *10*. https://doi.org/10.1016/j.heliyon.2024.e39630

S, M. (2023). Skema profiling karakteristik peserta didik dalam merancang pembelajaran berdiferensiasi. *Jurnal Pembelajaran, Bimbingan, Dan Pengelolaan Pendidikan*, *3*(6). https://doi.org/10.17977/um066v3i62023p3

Schildkamp, K., Kleij, F. M. Van Der, Heitink, M. C., Kippers, W. B., & Veldkamp, B. P. (2020). Formative assessment : A systematic review of critical teacher prerequisites for classroom practice. *International Journal of Educational Research*, *103*. https://doi.org/10.1016/j.ijer.2020.101602

Sedanza, M. A. C., & Abatayo, J. A. (2026). Beyond the average : a systematic review and meta-analysis of differentiated instruction for diverse English learners. *Frontiers in Education*. https://doi.org/10.3389/feduc.2026.1906974

Sinha, T., & Kapur, M. (2021). *When Problem Solving Followed by Instruction Works : Evidence for Productive Failure* (Vol. 91, Number 5). https://doi.org/10.3102/00346543211019105

Smale-jacobse, A. E., Meijer, A., Helms-lorenz, M., & Maulana, R. (2019). Differentiated Instruction in Secondary Education : A Systematic Review of Research Evidence. *Frontiers in Psychology*, *10*. https://doi.org/10.3389/fpsyg.2019.02366

Sudiar, T. (2026). Transformasi Motivasi Belajar Siswa melalui Pembelajaran Berdiferensiasi Berbasis Teori Behavioristik di Sekolah Dasar. *Journal Genta Mulia*, *17*(2), 10–17.

Sweller, J. (1988). Cognitive Load During Problem Solving : Effects on Learning. *Cognitive Science*, *12*(2), 257–285.

Sweller, J., van Merrienboer, J. J. G., & Paas, F. G. W. C. (1998). Cognitive Architecture and Instructional Design. *Educational Psychology Review*, *10*(3), 251–296. https://doi.org/10.1023/A:1022193728205

Tetzlaff, L., Simonsmeier, B., Peters, T., & Brod, G. (2025). A cornerstone of adaptivity – A meta-analysis of the expertise reversal effect. *Learning and Instruction*, *98*. https://doi.org/10.1016/j.learninstruc.2025.102142

Vgotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Cambridge, MA: Harvard University Press. 176 pages.

Wang, X., Maeda, Y., & Chang, H. (2025). Computers & Education Development and techniques in learner model in adaptive e-learning system : A systematic review. *Computers & Education*, *225*.

Wood, D., Bruner, J. S., & Ross, G. (1976). THE ROLE OF TUTORING IN PROBLEM SOLVING *. *Journal of Child Psychology and Psychiatry*, *17*(2). https://doi.org/10.1111/j.1469-7610.1976.tb00381.x

Wrigley, T. (2019). The problem of reductionism in educational theory : Complexity , causality , values. *Power Education*, *1*(2). https://doi.org/10.1177/1757743819845121

Ziernwald, L., Hillmayr, D., & Holzberger, D. (2022). Promoting High-Achieving Students Through Differentiated Instruction in Mixed-Ability Classrooms — A Systematic Review. *Journal of Advanced Academics*, *33*(4), 540–573. https://doi.org/10.1177/1932202X221112931

Zimmerman, B. J. (2002). Becoming a Self-Regulated Learner: An Overview. *Theory Into Practice*, *41*(2), 64–70. https://doi.org/10.1207/s15430421tip4102_2