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A critical review of teaching models with particular reference to Bruner's discovery learning approach

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Abstract

Teaching models provide systematic frameworks for organising teaching-learning experiences in accordance with educational objectives, learner characteristics and the nature of subject matter. The development of teaching models reflects the movement of education from predominantly teacher-centred transmission toward approaches that recognise cognitive activity, social interaction, personal development and behavioural change. Among the major classifications of teaching models, the framework associated with Joyce and Weil identifies four broad families which are Information Processing, Social Interaction, Personal, and Behavioural Systems. The present paper critically reviews the concept, characteristics, classification, educational significance and limitations of teaching models, with special reference to Jerome S. Bruner's discovery learning model. Bruner's educational thought emphasises the structure of knowledge, readiness for learning, active cognitive engagement, discovery and the spiral organisation of curriculum. His 'The Process of Education' provides a foundational account of these ideas. The paper further examines Bruner's three modes of representation enactive, iconic and symbolic and the implications of discovery-oriented learning for classroom practice. Particular attention is given to the distinction between pure or unassisted discovery and guided or enhanced discovery. Empirical reviews indicate that unassisted discovery does not consistently outperform explicit instruction, whereas enhanced discovery supported by feedback, scaffolding, worked examples and elicited explanations can produce more favourable learning outcomes. Similarly, Mayer's review concluded that guided discovery was more effective than pure discovery in the studies examined. The paper therefore proposes a balanced interpretation of Bruner's model in which learner exploration is combined with purposeful teacher guidance.

Keywords: Teaching Models, Instructional Models, Bruner, Discovery Learning, Guided Discovery, Spiral Curriculum, Cognitive Learning.

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1. Introduction

Teaching is a purposeful and systematic process through which teachers create conditions for learners to acquire knowledge, develop skills, construct understanding and apply learning to different situations. The changing objectives of education have resulted in the development of several approaches to teaching. Contemporary classrooms increasingly require learners not merely to remember information but also to analyse, interpret, investigate, communicate, solve problems and apply knowledge. Teaching models provide systematic frameworks for organising such learning experiences. Joyce and Weil conceptualised models of teaching as broad patterns that can guide curriculum development, instructional materials and classroom instruction. Their framework groups teaching models into four major families: Information Processing, Social Interaction, Personal, and Behavioural Systems. Within the Information Processing family, approaches such as concept attainment, inquiry and related cognitive models emphasise the development of learners' intellectual capacities. Bruner's contribution is particularly important because his educational theory gave a central place to the learner's active engagement with knowledge. Bruner's 'The Process of Education' addressed the structure of knowledge, readiness for learning, intuitive thinking and curriculum organisation, and became particularly influential for the idea of a spiral curriculum. Discovery learning associated with Bruner has subsequently generated considerable discussion. The central issue is not whether learners should be active, but how much guidance should be provided during that activity. Contemporary research therefore distinguishes between unassisted discovery and guided or enhanced discovery. This distinction makes Bruner's model particularly appropriate for a critical review rather than a purely descriptive treatment. Prakasha (2022) highlighted the significance of active learning and student engagement in Indian teacher education, supporting learner-centred approaches that encourage participation and meaningful learning. Katal (2022) demonstrated the educational value of peer observation in the Indian context, indicating that collaborative and reflective practices can strengthen teaching and learning processes. Varghese et al. (2024) reported that an active-learning strategy produced positive learning outcomes compared with conventional lecture-based teaching, reinforcing the importance of learner participation. Chauhan et al. (2024) found that experiential exposure to active-learning strategies enhanced learners' perceptions of interactive and student-centred teaching approaches. Novikasari et al. (2025) examined Bruner-based discovery learning and reported its relevance for developing mathematical reasoning, providing recent evidence for the application of discovery-oriented instruction. Gorbunova et al. (2023) critically examined inductive teaching from the perspective of cognitive load theory, highlighting the importance of appropriate instructional guidance when learners construct knowledge independently. Zhong et al. (2022) proposed a taxonomy of teaching models in STEM education, demonstrating the diversity of instructional approaches and the need to select models according to learning objectives and contexts. Mufid et al. (2023) applied Bruner's cognitive theory to discovery learning and found its usefulness in supporting learner engagement and the development of language-learning processes. Ausubel-related research (2023) reaffirmed the importance of meaningful learning and prior cognitive structure, providing a useful theoretical contrast to Bruner's discovery-oriented approach.

2. Objectives

1. explain the concept and nature of teaching models
2. examine major families of teaching models
3. analyse the educational significance of teaching models
4. explain Bruner's educational thought and discovery learning model
5. examine the principles, characteristics and instructional process of discovery learning
6. analyse the benefits and limitations of Bruner's approach
7. distinguish pure discovery from guided discovery
8. compare Bruner's approach with selected educational theorists and teaching models
9. examine the implications of Bruner's model for teacher education and classroom teaching

3. Methodology

The paper adopts a critical narrative review approach. Foundational educational works and peer-reviewed research concerning teaching models, Bruner's educational theory and discovery learning were examined. Particular attention was given to peer-reviewed research and meta-analytic evidence concerning the effectiveness of discovery-oriented instruction. The review combines conceptual analysis, theoretical interpretation, comparative analysis and critical examination of empirical evidence.

4. Concept of teaching models

Teaching model, method, strategy and technique these concepts are related but should not be treated as identical. Teaching Model (broad systematic framework for teaching), teaching method (general procedure used for presenting and facilitating learning), teaching strategy (planned approach selected to achieve an objective), teaching technique (specific classroom procedure or device), teaching skill (specific teacher behaviour used during instruction). A teaching model generally provides guidance regarding instructional objectives, sequence of activities, teacher's behaviour, learner's behaviour, classroom interaction, learning resources, support systems and assessment. Joyce and Weil's framework treat teaching models as systematic approaches that can shape curriculum, instructional materials and classroom teaching. Thus, a teaching model is broader than an isolated classroom technique. Joyce and Weil's Framework, first introduced in their classic book "Models of Teaching", is a structured educational methodology that categorizes different approaches to teaching based on how human beings learn. Four major families of teaching models by Joyce and Weil's framework are given in table 1.

Family	Central emphasis	Representative examples
Information Processing	Thinking, information organisation and concept development	Concept Attainment, Inquiry
Social Interaction	Group interaction and social learning	Group Investigation, Role Playing
Personal	Self-development and individual growth	Non-directive Teaching

Behavioural Systems	Observable behaviour and systematic reinforcement	Direct/Programmed approaches
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Table1: Four major families of teaching models by Joyce and Weil's framework

In information processing family focuses are on the development of intellectual abilities, concept formation, inquiry, information organisation and problem solving. Social interaction family emphasise on learning through interaction, cooperation, group processes and social problem solving. In personal family emphasis is on individual development, self-understanding, autonomy and personal meaning. In behavioural systems family emphasise on observable behaviour, structured instruction, feedback and reinforcement.

5. Educational benefits of teaching models

Teaching models contribute to education in several ways. 1. systematic planning (a model provides teachers with an organised framework for planning instruction), 2. alignment with objectives (different models can be selected according to cognitive, affective, social or skill-related objectives), 3. active learning (several models provide opportunities for learners to participate actively in classroom processes), 4. higher-Order Thinking (inquiry, discovery and problem-oriented models can support analysis, reasoning and application), 5. teacher development (knowledge of multiple models expands the instructional repertoire of teachers), 6. learner diversity (different models can accommodate differences in learning needs, prior knowledge and classroom contexts).

6. Limitations of teaching models

No single teaching model can be expected to be optimal for every learner, objective and subject. Effective implementation depends upon teacher understanding and professional competence. Some models require substantially more classroom time than direct presentation. Certain models require specialised materials, technology or classroom arrangements. Rigid application can reduce flexibility and responsiveness to learners. Therefore, models should be regarded as instructional frameworks rather than rigid recipes.

7. Jerome S. Bruner and his contribution to education

Jerome S. Bruner was an influential cognitive psychologist whose work had a substantial impact on educational theory. His educational contribution is associated with structure of knowledge, readiness for learning, active learning, discovery, intuitive thinking, representation of knowledge, and spiral curriculum. Bruner's 'The Process of Education' was originally published by Harvard University Press in 1960 and is directly associated with his argument concerning the structure of knowledge, readiness and spiral curriculum.

7.1. Bruner's view of learning

Bruner's educational approach places considerable emphasis on the learner's active cognitive participation. Instead of considering learning simply as the accumulation of facts, the learner is encouraged to understand relationships, structures and principles. This perspective has several implications 1. learners should actively engage with knowledge 2. fundamental structures of disciplines should be emphasised 3. learners should have opportunities to investigate relationships 4. instruction should take account of readiness and 5. important concepts can be revisited at increasing levels of complexity.

7.2. Discovery Learning

Discovery learning is an instructional approach in which learners are provided with opportunities to explore information, investigate relationships, identify patterns and arrive at concepts or principles. In a discovery-oriented classroom, the teacher may present a problem, examples, data, materials, observations, questions or situations requiring explanation. Learners then investigate the material and develop an understanding of the underlying relationship. The important point is that discovery does not necessarily mean that the teacher disappears from the instructional process.

7.3. Principles of Bruner's discovery- oriented approach

1. **Active participation** – Learners actively engage in constructing knowledge.
2. **Learning through discovery** – Students discover concepts and principles through exploration.
3. **Readiness for learning** – Instruction should correspond to the learner's readiness and cognitive level.
4. **Spiral curriculum** – Important concepts should be revisited with increasing complexity.
5. **Structure of knowledge** – Teaching should focus on the fundamental structure of the subject.
6. **Enactive representation** – Learning may begin through direct action and manipulation.
7. **Iconic representation** – Knowledge may be developed through images, diagrams, and visual representations.
8. **Symbolic representation** – Abstract knowledge may be expressed through language, symbols, and formulas.
9. **Problem solving** – Learners should be encouraged to identify and solve problems.
10. **Inquiry-Based learning** – Students should investigate questions and explore possible explanations.
11. **Exploration** – Learning should provide opportunities for experimentation and investigation.
12. **Intrinsic motivation** – Curiosity and the satisfaction of discovery should encourage learning.
13. **Scaffolding** – Appropriate temporary support should be provided and gradually withdrawn.
14. **Teacher as facilitator** – The teacher should guide and support learners rather than merely provide information.
15. **Concept formation** – Learners should identify patterns, relationships, categories, and principles.
16. **Learning by doing** – Practical experiences should contribute to meaningful understanding.
17. **Learner autonomy** – Students should progressively become independent learners.
18. **Transfer of learning** – Learners should apply acquired concepts to new situations.
19. **Feedback and reinforcement** – Timely feedback should help learners evaluate and improve their understanding.
20. **Contextual learning** – Learning activities should be connected with meaningful and relevant situations.
21. **Progressive abstraction** – Learners should move gradually from concrete experiences toward increasingly abstract and symbolic understanding.

7.4. Bruner's Three Modes of Representation

One of the most important concepts associated with Bruner is the progression through three modes of representing knowledge. Bruner's three modes of representation include **Enactive**, which represents knowledge through action such as performing an experiment; **Iconic**, which represents knowledge through images or visuals such as diagrams or pictures; and **Symbolic**, which represents knowledge through language or symbols such as formulas or verbal explanations.

7.5. Spiral curriculum

Bruner's spiral curriculum proposes that important ideas can be introduced early and revisited later at increasing levels of complexity. For example, the concept of ecosystem may be introduced through simple observation at an early level, followed by food chains and energy flow, and subsequently developed into ecological relationships and systems thinking. The principle is therefore not merely repetition. It involves progressive deepening of understanding. Bruner's foundational work is explicitly associated with the spiral curriculum, and later scholarship has examined how the idea can be implemented effectively.

7.6. Process of guided discovery learning

A practical guided-discovery lesson follows this sequence 1. **Problem/Situation** (the teacher presents a meaningful problem), 2. **Exploration** (learners examine materials, examples or information), 3. **Observation** (learners identify similarities, differences or patterns), 4. **Questioning** (learners formulate questions), 5. **Hypothesis** (Possible explanations are proposed), 6. **Investigation** (the explanations are examined using evidence), 7. **Concept Formation** (learners identify the underlying concept or principle), 8. **Teacher Feedback** (the teacher corrects misconceptions and provides appropriate support), 9. **Application** (the concept is applied to a new situation), 10. **Reflection** (learners explain what they have learned and how they reached the conclusion)

7.7. Role of the teacher and the learner

In guided discovery, the teacher is not merely a passive observer, the teacher acts as facilitator, questioner, organiser, provider of resources, diagnostician, scaffolder, feedback provider and evaluator. The teacher determines the level of support according to learners' needs. The learner is expected to observe, explore, ask questions, compare, classify, hypothesise, investigate, infer, formulate concepts, apply knowledge and reflect on learning. Thus, the learner has an active cognitive role.

7.8. Benefits of Bruner's discovery learning model

1. **Promotes active learning** – Learners actively participate in the learning process rather than passively receiving information. 2. **Develops problem-solving skills** – Students learn to identify problems, explore alternatives, and develop solutions. 3. **Enhances critical thinking** – Discovery activities encourage analysis, reasoning, comparison, and evaluation. 4. **Improves conceptual understanding** – Learners develop deeper

understanding by discovering relationships and principles themselves. 5. **Encourages inquiry and curiosity** – The model stimulates questioning, investigation, exploration, and intellectual curiosity. 6. **Strengthens knowledge retention** – Actively constructed knowledge can be easier to understand and recall. 7. **Develops Learner autonomy** – Students gradually become more independent and responsible for their learning. 8. **Supports intrinsic motivation** – The satisfaction of finding solutions and discovering concepts can encourage continued learning. 9. **Facilitates transfer of learning** – Learners can apply discovered principles to unfamiliar or new situations. 10. **Encourages creativity** – Open-ended exploration provides opportunities for generating and testing different ideas. 11. **Promotes learning by doing** – Practical activities connect theoretical concepts with direct experience. 12. **Supports different forms of representation** – Enactive, iconic, and symbolic representations can help learners understand concepts progressively. 13. **Accommodates individual differences** – Learners can explore problems at different levels and through different approaches. 14. **Develops metacognitive skills** – Learners reflect on their strategies, reasoning, and conclusions during discovery. 15. **Strengthens scientific inquiry skills** – Observation, classification, hypothesis formation, experimentation, and conclusion-drawing can be developed. 16. **Encourages meaningful learning** – New knowledge is connected with learners' existing experiences and cognitive structures. 17. **Supports long-term intellectual development** – Through the spiral curriculum, important concepts can be revisited and progressively deepened. 18. **Enhances classroom engagement** – Interactive discovery activities can increase learner involvement and participation. 19. **Develops confidence in learning** – Successfully solving problems independently can strengthen learners' confidence in their ability to learn. 20. **Promotes higher-order thinking** – The approach can engage learners in analysis, synthesis, evaluation, and application rather than simple recall.

7.9. Criticism of Bruner's discovery learning model

1. **High cognitive load** – Unguided discovery can place excessive demands on learners' working memory, particularly for novices. 2. **Need for adequate guidance** – Learners may struggle when instructional support, feedback, or scaffolding is insufficient. 3. **Time consuming** – Discovery activities often require more classroom time than direct instruction. 4. **Difficulty for novice learners** – Students with limited prior knowledge may find independent discovery challenging. 5. **Teacher Expertise Required** – Effective discovery learning requires teachers to design appropriate problems, questions, scaffolds, and feedback. 6. **Curriculum constraints** – Extensive discovery activities may be difficult to accommodate within tightly structured curricula and limited teaching time. 7. **Resource requirements** – Experiments, materials, technology, and other learning resources may be necessary for effective implementation. 8. **Risk of misconceptions** – Without appropriate feedback and guidance, learners may construct incorrect explanations or concepts. 9. **Unequal learning outcomes** – Students with different levels of prior knowledge, motivation, or learning skills may benefit differently. 10. **Classroom management challenges** – Managing exploratory and inquiry-based activities can be difficult, particularly in large classes. 11. **Assessment Difficulties** – Assessing the process of exploration and individual discovery can be more complex than assessing conventional learning outcomes. 12. **Not suitable for every content area** – Some factual, procedural, or highly structured content

may be learned more efficiently through explicit instruction. 13. **Risk of inefficient learning** – Excessive exploration without clear learning objectives may divert learners from essential concepts. 14. **Dependence on prior knowledge** – Successful discovery often requires sufficient background knowledge to interpret observations and identify meaningful patterns. 15. **Limited effectiveness of pure discovery** – Research has generally raised greater concerns about unassisted or minimally guided discovery than about guided discovery, making the amount and quality of instructional guidance a central issue. 16. **Potential frustration** – Learners who cannot identify the intended relationship or solution may experience confusion or frustration. 17. **Implementation in large classes** – Providing individualized guidance and feedback can be difficult when student numbers are high.

The major criticism is not necessarily discovery learning itself, but how much guidance is provided; guided discovery with appropriate scaffolding can address many of the limitations associated with pure or unassisted discovery.

7.10. Empirical evidence: pure versus guided discovery

Discovery learning promotes active participation, problem-solving, inquiry skills, conceptual understanding, learner autonomy, motivation, knowledge application, and critical thinking, but may require considerable time and resources, be difficult for novices and large classes, increase cognitive load, require skilled teacher guidance, face curriculum constraints, and may be ineffective when conducted as pure discovery. Mayer's 2004 review examined research across several areas of discovery learning and concluded that guided discovery was more effective than pure discovery for learning and transfer in the studies reviewed. Alfieri et al. (2011) conducted two meta-analyses involving 164 studies. Their analyses found that explicit instruction generally outperformed unassisted discovery, whereas enhanced discovery showed favourable outcomes compared with other forms of instruction. Their findings particularly highlighted the value of feedback, worked examples, scaffolding and elicited explanations. These findings do not imply that active learning or inquiry should be abandoned. Rather, they indicate that activity should be accompanied by appropriate instructional support.

7.11. Bruner Compared with Other Major Theorists

Bruner emphasized discovery learning, spiral curriculum, and enactive–iconic–symbolic representation, Piaget focused on cognitive development and developmental stages, Vygotsky proposed the zone of proximal development (ZPD) and socially mediated learning, Ausubel emphasized advance organizers and meaningful reception learning, Skinner developed operant conditioning based on reinforcement and behaviour, Bandura focused on social learning through observation and modelling, Rogers advocated non-directive teaching for personal development, and Bloom developed mastery learning for mastery of learning objectives.

7.12. Bruner and Piaget

Both Bruner and Piaget are associated with cognitive approaches, but their educational emphases differ. Piaget is associated with cognitive developmental stages, schemas, developmental processes, and

assimilation/accommodation, whereas Bruner is associated with discovery learning, spiral curriculum, modes of representation, instructional organisation, and the structure of knowledge.

Assimilation + Accommodation → Piaget

Discovery + Spiral Curriculum → Bruner

7.13. Bruner and Ausubel

Bruner emphasizes discovery-oriented learning, learner investigation, discovery, structure and inquiry, and spiral curriculum, whereas Ausubel emphasizes reception-oriented learning, organized knowledge presentation, advance organizers, existing cognitive structure, and meaningful verbal learning.

Advance Organizer → Ausubel

Discovery Learning → Bruner

7.14. Bruner and Vygotsky

Both approaches recognise the importance of the learner's active development, but Vygotsky gives particularly strong emphasis to social mediation and the Zone of Proximal Development. Bruner emphasizes discovery learning, structure of knowledge, representation, scaffolding, and spiral curriculum, whereas Vygotsky emphasizes social mediation, cultural tools, language and interaction, ZPD-related support, and sociocultural development.

7.15. Bruner and Skinner

Bruner emphasizes a cognitive orientation, discovery learning, concept formation, internal cognitive activity, and the active learner, whereas Skinner emphasizes a behaviourist orientation, reinforcement, behaviour modification, observable behaviour, and behaviour shaped by contingencies.

8. Application in science and environmental education

Discovery-oriented teaching is particularly relevant to science education because scientific learning involves observation, questioning, experimentation, evidence, hypothesis formation, interpretation and explanation. For example, while teaching factors affecting photosynthesis, the teacher can provide experimental observations and ask students to identify the relationship between light, carbon dioxide and photosynthetic activity. The teacher can guide students toward the principle rather than simply providing the conclusion at the beginning.

Bruner's model can also be applied effectively to environmental education. For example, students may be asked to investigate; Why is the water quality of a local water body changing? Students can observe the site, collect available information, identify possible sources of pollution, compare observations, formulate explanations, examine evidence, discuss consequences and propose possible interventions. Such an approach connects conceptual learning with real-world environmental problems.

9. Implications for teacher education

Teacher education programmes should prepare trainee teachers to select teaching models according to learning objectives, subject matter, learner characteristics, prior knowledge, available resources, classroom size, time, assessment requirements. Teacher educators should particularly emphasise that learner-centred does not mean absence of teacher. A competent teacher knows when to explain, demonstrate, question, guide, scaffold, allow exploration, provide feedback and evaluate.

10. Critical discussion

The literature suggests that the most productive interpretation of Bruner's contribution is neither an unconditional endorsement nor a rejection of discovery learning. The key issue is instructional design. Pure discovery can impose substantial demands on learners, particularly when they lack relevant prior knowledge. Research by Kirschner et al. highlights the importance of guidance, especially for novice learners. At the same time, Alfieri et al.'s meta-analysis indicates that enhanced discovery can be beneficial when instructional support is incorporated. Consequently, the pedagogical choice can be conceptualised as a continuum: Direct Explanation → Guided Practice → Guided Discovery → Independent Inquiry. The appropriate point on this continuum depends upon learner expertise, complexity of content, learning objective, time available, teacher expertise and instructional context. This perspective is more consistent with evidence than treating any one teaching model as universally superior.

11. Proposed integrated framework

Based on the critical review, an effective contemporary interpretation of Bruner's approach may be represented as Prior Knowledge → Problem / Learning Situation → Teacher Guidance → Learner Exploration → Questioning and Investigation → Scaffolding and Feedback → Concept Formation → Application → Reflection. This framework preserves the central importance of learner activity while recognising the instructional role of the teacher.

12. Conclusion

Teaching models provide systematic frameworks for organising instructional experiences and responding to different educational objectives. The classification associated with Joyce and Weil demonstrates that teaching can be conceptualised through information processing, social interaction, personal development and behavioural systems. Discovery learning, spiral curriculum, enactive–iconic–symbolic representation and concept attainment (Bruner); advance organizer (Ausubel); assimilation and accommodation (Piaget); Zone of proximal development (ZPD) (Vygotsky); operant conditioning (Skinner); observational learning (Bandura); non-directive teaching (Rogers); mastery learning (Bloom); and four families of models of teaching (Joyce & Weil). Bruner's contribution is particularly significant within cognitive and learner-centred approaches. His

emphasis on discovery, structure of knowledge, readiness, representation and spiral curriculum has had a lasting influence on educational thought. His foundational work 'The Process of Education' remains central to understanding these ideas. However, contemporary evidence requires a careful distinction between pure discovery and guided discovery. Mayer's review found stronger support for guided discovery than pure discovery in the research considered, while Alfieri et al.'s meta-analysis found that unassisted discovery generally did not outperform explicit instruction, whereas enhanced discovery incorporating support mechanisms produced favourable outcomes. Therefore, the educational significance of Bruner's model is best understood through the principle of guided intellectual activity. The learner should have meaningful opportunities to explore, question, investigate and construct understanding, while the teacher provides appropriate structure, scaffolding, feedback and clarification. For contemporary teacher education, the most useful lesson is consequently not that one teaching model should replace all others. Rather, teachers should develop the professional capacity to select, combine and adapt teaching models according to the learner, objective, content and context.

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