

# LOCAL WISDOM – BASED SCIENCE EDUCATION IN THE PRESPECTIVE OF LEARNING THEORY

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**Abstract:** The diverse wealth of Indonesia's local wisdom has not been widely utilized as a learning resource. In many studies showed that local wisdom-based science learning encompasses scientific knowledge and holds strong potential for developing higher-order thinking skills and strengthening national identity. This study aims to analyse of local wisdom-based learning from the perspective of learning theories. This research used quantitative descriptive with an analysis literature approach. Sources of research data include the potential analysis of local wisdom-based science learning reviewed from the perspective of learning theories. The findings showed that local wisdom-based science learning aligns with Ausubel's theory of meaningful learning, Piaget's theory of cognitive development as personal constructivist, and Vygotsky's theory of sociocultural learning and Bruner's theory of inquiry learning. Therefore, it can be concluded that local wisdom-based learning is highly relevant to cognitive development theories and has strong potential to enhance students' higher order thinking skills and strengthening national identity.

**Keywords:** Science education, Local wisdom, Ausubel's learning theory, Piaget's learning theory, Bruner's learning theory, Vygotsky's of sociocultural learning theory.

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## 1 Introduction

The 21st century's global digital era is characterized by the rapid development of information technology and its use in various aspects of life, including education. Advances in information technology have made the world seem borderless, facilitating access to various information, including the influence of foreign cultures that can erode local culture (local wisdom). However, the impact of technological advancements in the global digital era seems to be more powerful, pushing the influx of foreign cultures like a powerful wave that can erode the foundations of culture as local wisdom. This causes people to perceive foreign cultures as more appealing, leading them to neglect and preserve their own local wisdom. Meanwhile, local wisdom can serve as a bulwark in strengthening cultural identity as a nation (Indonesia) (Hendrizal, 2020). If not given serious attention, this could sooner or later result in the loss of Indonesian identity. This can slowly but surely have an impact on the erosion of local wisdom, which can erode the identity of the In-

donesian nation, known for its multicultural society.

Quoting Nelson Mandela's statement that "education is the most powerful weapon to change the world," education can be a strategic way to overcome this identity crisis. Why education? Because education has broad access and can reach various levels. Science is very close and inseparable from the daily lives of people, including the culture that develops in society. Science education, as a field of science closely related to natural phenomena that occur in everyday life as culture (local wisdom) and has developed in society, can be a bulwark in facing this identity crisis as a source of science learning by integrating it into education. Local wisdom can include various forms such as: ceremonial traditions, and various arrangements in community life (such as: traditional food, traditional medicine, traditional dance, traditional musical instruments, traditional houses, traditional weapons, etc.) which contain science as scientific knowledge (Mungmachon, 2012). Various studies show that local wisdom can be reconstructed and identified as containing scientific values (Jannah et al., 2024; Larassati et al., 2025).

Considering the characteristics of science, local wisdom can be used as a resource in science learning by integrating it into learning. However, public knowledge and awareness of local wisdom tend to be lacking. Local wisdom has not been optimally utilized in education, especially in science learning. This is caused by many factors. The lack of socialization and the lack of knowledge of science teachers about local wisdom, especially viewed from the academic aspect (scientific knowledge) and the pedagogical aspect (cognitive psychology) are the causes. Generally, science teachers tend to not understand that local wisdom is very effective as a learning resource, especially viewed from the perspective of learning theory. The root of the problem lies in how the relevance and potential of local wisdom-based science learning is viewed from the perspective of learning theory. Therefore, the purpose of writing this article is to analyze the relevance and potential of local wisdom-based science learning reviewed from various learning theory perspectives, including: Jean Piaget's cognitive learning theory, Jerome Bruner's discovery learning theory, Vygotsky's social learning theory, and Ausubel's meaningful learning theory.

## 2 METHODS

This study employed a quantitative descriptive research design with a literature analysis approach. The research was conducted by reviewing, identifying, and synthesizing relevant literature on local wisdom-based science learning in relation to various learning theories.

### 2.1 Research Data Source

The primary data sources consist of scientific articles, conference proceedings, and relevant books published between 2015–2025 that discuss:

1. The integration of local wisdom in science education.
2. The theoretical foundations of learning, particularly Piaget's cognitive development theory, Bruner's discovery learning theory, Vygotsky's sociocultural theory, and Ausubel's meaningful learning theory.
3. Empirical studies that highlight the impact of local wisdom-based learning on students' motivation, higher-order thinking skills, and cultural identity.

### 2.2 Data Collection

The literature was collected through systematic searching in academic databases such as Google Scholar, Scopus, and ERIC using keywords including local wisdom, science education, constructivist learning theory, sociocultural learning theory, discovery learning, meaningful learning. Articles were selected based on the following criteria:

1. Published in the last ten years (2015–2025).
2. Written in English or Indonesian.
3. Discussing both theoretical perspectives and empirical findings related to local wisdom in science learning.

### 2.3 Data Analysis

The data were analyzed using descriptive content analysis. Each selected article was categorized according to the relevant learning theory perspective. Then, the findings were synthesized to identify the relevance, potential, and challenges of implementing local wisdom-based science education. The analysis focused on mapping how local wisdom aligns with Piaget's, Bruner's, Vygotsky's, and Ausubel's theories, as well as its implications for enhancing higher-order thinking skills and strengthening cultural identity.

## 3 RESULT AND DISCUSSION

### 3.1 Piaget Learning Theory



**Figure 1.** Jean Piaget Scientist of Personal Constructivist Learning Theory Source: Google

This learning theory is also called the personal constructivist learning theory, where students construct their knowledge personally, not through the transfer of knowledge. According to Piaget (1947), knowledge cannot be constructed individually but through interaction with the environment. Everything learned is organized in a cognitive structure called schemata. A schema is a coherent, repeatable sequence of actions, with closely interrelated component actions organized

by a core meaning. A schema is a mental representation of something, both concrete and abstract, that can be applied to an object, situation, or event when students interact with their environment. Through this mental schema, students use it in thinking and acting and interpret new knowledge to connect it with the knowledge they already have in their schema. Because learning occurs through interaction between students and their environment, learning must begin with student experience (Blake & Pope, 2008). The teacher's role in learning is to provide opportunities for students to understand their experiences by connecting their previous knowledge with the new knowledge they acquire. If students lack the necessary knowledge, then the new knowledge that the teacher will teach may be too far from their cognitive boundaries and their ability to remember it consciously will decrease rapidly, unless the knowledge is immediately connected with knowledge that already exists in their cognitive structure. Piaget also explained that understanding knowledge involves the following stages: assimilation, accommodation, adaptation, and equilibrium. When individuals interact with their environment, an organizational process occurs, namely the integration of new knowledge into their cognitive schema or structure. Assimilation occurs when individuals perceive an object or event as new knowledge within a previously formed framework of understanding. The inclusion of new and relevant elements in a pre-existing schema allows individuals to expand their understanding. If external reality (new knowledge) does not match internal reality (initial knowledge), a state of imbalance (disequilibrium) will occur, usually accompanied by cognitive conflict. Next, accommodation will occur, namely the adjustment process that occurs when the schema is insufficient to accommodate or the entry of new information that is not appropriate (Schunk, 1995; (Schunk, 2020)). If this condition occurs, an adjustment process (adaptation) will occur, namely changes or modifications to the schema to accommodate the new knowledge until harmony (equilibrium) is created. The elements that enter as new knowledge cause knowledge to become more comprehensive, ultimately enabling individuals to understand the knowledge that exists in their surroundings (Bhattacharya & Han, 2010). Thus, cognitive development can grow driven by the presence of equilibrium and disequilibrium. Equilibrium is a mechanical self-regulation process necessary to regulate the balance of assimilation and accommodation processes, thus enabling individuals to integrate new experiences into their cognitive schemes or struc-

tures. Thus, if an individual can reach the equilibrium stage, it means they are at a higher intellectual level than before (Dahar, 2012).

In the context of science learning, local wisdom is closely related to cultural events in the students' surrounding communities. Local wisdom integrated into science learning will become new knowledge for students. However, in the schema (students' cognitive structure), knowledge about this culture already exists, although incompletely. When local wisdom-based science learning is taught, this knowledge will be assimilated, accommodated, and adapted within the students' schema (cognitive structure) until equilibrium is achieved. The new elements of knowledge about local wisdom that are introduced will make students' knowledge more comprehensive, ultimately enabling them to understand the local wisdom knowledge that exists in their surroundings while fostering a sense of ownership and pride in their culture. Because local wisdom is closely related to the natural environment, it can also foster environmental awareness and preservation.

### 3.2 Bruner Learning Theory



**Figure 2.** Jarome Bruner Scientist of Inquiry Learning Theory Source: Google

This learning theory is also called discovery learning theory or known as inquiry learning. Bruner (1996) argues that discovery learning is relevant to the essential nature of humans who always want to actively seek knowledge, solve problems, and ultimately gain meaningful knowledge. In addition, Bruner said that good learning is based on discovery, where knowledge is obtained by students independently, not given or transferred knowledge. The most important part of the learning process is how information is conveyed to be accepted by students by involving schemata transformation through direct experience. Knowledge gained through direct experience will be durable and easier to remember, easy to apply in new situations, and improve thinking and reasoning. The process of seeking knowledge that is carried out actively and independently by students requires a thought process and

will produce better results (Dahar, 2012). According to Bruner (1996), the best way to learn concepts is by constructing the concepts themselves through students' interactions with their environment in the form of exploring and manipulating objects, asking questions, and conducting investigations (experiments).

According to Bruner (1996), learning occurs through the following stages: enactive, iconic, and symbolic. Enactive refers to motor-knowledge activities undertaken by students in an effort to understand their surroundings. Iconic refers to the effort to understand objects through images and verbal visualization. Symbolic refers to the ability to have abstract ideas or concepts influenced by logical reasoning. In the context of science learning, discovery learning involves a series of science process skills such as observing/identifying problems, asking questions, formulating hypotheses, designing and conducting investigations, and drawing conclusions (Ozdem-Yilmaz & Bilican, 2020). Science learning integrated with local wisdom is highly relevant to Bruner's learning theory. The iconic stage occurs when students are confronted with a phenomenon or case related to local culture. Students are required to identify the problem through observation activities. Through these activities, students use their motor skills in an effort to understand their surroundings. When students conduct investigations, data will be obtained, where students are required to present the data obtained in the form of tables, images, graphs, etc. as verbal visualizations. The symbolic stage occurs when students are required to use their ideas or concepts to find creative and innovative solutions to problems. Thus, through discovery learning, students are trained not only to develop science process skills, but also to become more interesting and enjoyable, while also training students to think at a higher level.

In the context of science learning, scientific concepts are acquired through a process of inquiry (discovery). This means that scientific concepts are not acquired through the transfer of knowledge, but through inquiry or are constructed independently by students by interacting with their environment. Scientific concepts contained in Local wisdom that are integrated into science learning become new knowledge for students. In discovery learning, students can use their motor skills using their five senses to understand the surrounding environment through a series of science process skills such as: observing, measuring, identifying, etc. local wisdom that is being studied. In this case, students are at the enactive stage. Next, students

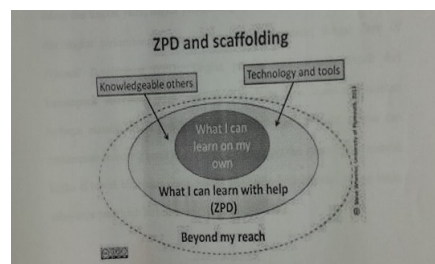
try to understand the objects in local wisdom in the form of images and verbal visualizations, here students are at the iconic stage. Furthermore, through the local wisdom they learn, students are able to develop abstract ideas or concepts influenced by their logical reasoning skills, or students are at the symbolic stage. Through the enactive, iconic, and symbolic stages, students will discover and understand scientific concepts well. Thus, the presence of local wisdom in science learning greatly helps students construct their knowledge more comprehensively. Ultimately, students can understand the knowledge of local wisdom in their surroundings well while fostering a sense of ownership and pride in their culture. Thus, local wisdom can be a driving force in strengthening one's identity and sense of nationalism, as well as pride in one's own culture (Kholidah, 2019).

### 3.3 Vygotsky Learning Theory



**Figure 3.** Lev Vygotsky Scientist of Sociocultural Learning Theory Source: Google

Vygotsky's learning theory is known as sociocultural theory. This theory places greater emphasis on the social environment as a facilitator of students' cognitive development. Vygotsky believes that interactions with others can foster cognitive development, transforming learning experiences (Arends, 2012). Cognitive development occurs through a dialectical process of problem-solving experiences shared with peers. According to Vygotsky, there are three zones that play a role in students' cognitive development, as shown in Figure 4.



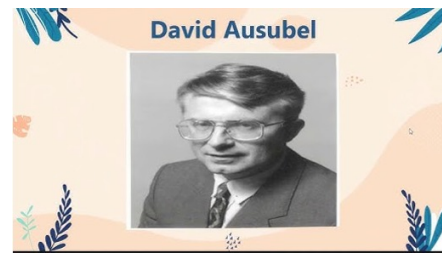
**Figure 4.** Zona of Cognitive Development Vygotsky Source: Google

Figure 4 shows that there are three zones in cognitive development, namely: Zone of Actual Development (ZAD), Zone of Proximal Development (ZPD), Zone of Potential Development (ZPotD). ZAD is a zone in the structure of cognitive development characterized by students being able to complete tasks independently without the help or guidance of others. ZPotD is a zone in the structure of cognitive development where students can complete tasks and solve problems beyond their capabilities. Students can reach the potential zone (ZPotD) if they are positioned first in the ZPD, which is the zone between ZAD and ZPotD. In this ZPD, learning is conditioned so that social interaction occurs and there is assistance (scaffolding) from others (teachers, peers, other people who are more competent (experts), etc. Scaffolding is assistance given by teachers to students in a gradual manner. When students are able to complete their tasks independently, then assistance will be stopped. Assistance can take various forms such as: questions, triggers, guidance, direction, etc. or according to the student's needs.

In the context of science learning integrated with local wisdom, new knowledge about local wisdom is provided through a learning process designed to facilitate social interactions such as: group work, interview activities with subjects or people who have competence in their fields, teachers, etc. Meanwhile, providing assistance (scaffolding) through local wisdom that can be packaged in various forms of learning resources, can be an effective means for students to interact socially with friends in their groups. Thus, the presence of local wisdom in science learning is expected to lead students to the ZPotD zone, so that students are able to complete their tasks beyond their abilities. Thus, the presence of local wisdom in science learning is very helpful in guiding students to develop their potential well. By having a good understanding of the local wisdom of their region, students will be proud and are expected to strengthen their identity as a nation (Indonesia).

### 3.4 Ausubel Learning Theory

Ausubel's (1968) learning theory is known as the theory of meaningful learning. According to [Agra et al. \(2019\)](#), Ausubel categorized learning into two dimensions. First, it relates to how learning materials are presented to students, either through reception or discovery. In discovery learning, students are required to connect prior knowledge with new knowledge, so that learning becomes meaningful (meaningful learn-



**Figure 5.** David Ausubel Scientist of Meaningful Learning Theory Source: Google

ing). Meanwhile, in reception learning, students only learn to memorize new information received from the teacher, so that learning is merely rote and less meaningful. Second, it relates to how students connect learning materials with existing cognitive structures. If concept formation is obtained through discovery, there will be assimilation between prior knowledge and new knowledge to be accommodated into the cognitive structure and then adapted until equilibrium is achieved. Meanwhile, if concept formation is obtained through reception, there will be no assimilation and no connection between new knowledge and the prior knowledge that students already have. As a result, the concepts learned are not retained in memory or learning is meaningless.

Ausubel's theory emphasizes higher-order thinking processes through students' cognitive involvement through the use of pattern recognition and concept association. Learning is said to be meaningful if a clear conscious experience is articulated and differentiated precisely which arises when potentially meaningful signs, symbols, concepts, or proportions are related and integrated into the individual's cognitive structure. According to Ausubel ([Dahar, 2012](#)) there are four principles in meaningful learning: 1) Advance Organizer (initial arrangement), which involves the use of introductory material to connect old material with new material that has a higher meaning; 2) Progressive Differentiation (progressive differentiation), which is material starting from general material before moving on to specific material; 3) Superordinate Learning (superordinate learning), which involves mastering previous material before learning new material; 4) Integrative Reconciliation (integration adjustment), which is learning concepts arranged hierarchically to build a deeper understanding. Thus, through meaningful learning, in addition to the information being easy to remember and lasting in memory, it facilitates understanding of subsequent material.

In the context of science learning integrated with

local wisdom, it is generally related to the culture that develops in the community. This is highly relevant to the theory of meaningful learning, where students understand procedural knowledge within the context of local wisdom, moving from the general to the specific, and the relationship between material they already possess and new material. In the apperception stage, the initial stage of science learning, teachers can use examples of local culture as a catalyst in learning. Knowledge of the local wisdom of the region can serve as prior knowledge for students to relate to the material they will learn. This stage can serve as an advance organizer, involving the use of introductory material to connect old material with new material, thus gaining greater meaning. The material can begin with general material before moving on to specific material (progressive differentiation). The apperception stage generally involves mastering previous material before learning new material as a prerequisite for knowledge (superordinate learning). Furthermore, learning concepts are arranged hierarchically to build a deeper understanding (integrative reconciliation). Thus, the scientific concepts learned by students, in addition to being easily remembered and long-lasting, facilitate understanding of subsequent material, making learning more meaningful.

### 3.5 The Results of Relevant research

Many studies have been conducted on science learning based on local wisdom, and the results show that it can have a positive impact on student motivation, thinking skills, and learning outcomes (Istiqomah et al., 2025; Lawton et al., 1980; Putri et al., 2025). The integration of local wisdom in science learning can also create a more conducive learning situation. The integration of local wisdom in science learning not only increases students' environmental awareness but also encourages creativity, critical thinking, and problem-solving skills. This is supported by Hasibuan (2022) who stated that the integration of conservation values and local wisdom in science learning aims to create a conducive learning situation that encourages students' awareness of the importance of nature, greater appreciation for local culture, and more successful understanding of science holistically while appreciating their cultural heritage. The integration of local wisdom in science learning can bridge the gap between science and students' culture and environment, creating a more meaningful learning experience and stimulating students' creativity in facing challenges and finding solutions to problems in their environment

(Darling-Hammond et al., 2020). However, a lack of teacher awareness and understanding, as well as limited resources, are inhibiting factors in its implementation (Zahro & Maulida, 2023), as well as the diversity of student interests and motivations (Yasir & Hartingsih, 2023).

## 4 CONCLUSION

Based on the discussion above, it can be concluded that:

1. The subject of science is closely related to nature and the environment, while culture cannot be separated from social life. Therefore, the integration of local wisdom in science learning needs to be optimally implemented.
2. Science learning based on local wisdom is highly relevant and supported by learning theories such as Piaget, Bruner, Vygotsky, and Ausubel.
3. Integrating local wisdom in science learning has a positive impact on student motivation, thinking skills, and learning outcomes. It increases students' environmental awareness, encourages creativity, critical thinking, and problem-solving skills, creates a more conducive learning environment, bridges the gap between science and students' culture and environment, creates a more meaningful learning experience, and stimulates students' creativity in facing challenges and finding solutions to problems in their environment.

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