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Research Article

Hammond's Cube Evaluation Model Adapted to Current Conditions: Is It Appropriate?

Ryan Angga Pratama[1]

[1]Department of Curriculum and Instruction, Mersin University, Mersin, Türkiye

Abstract
In the original model of "Hammond's Evaluation Cube (1967)", educational evaluation focused on three main dimensions: (a) Behavior, consisting of Cognitive, Affective, and Psychomotor aspects, (b) Instruction, consisting of Organization, Content, Method, Facilities, and Cost, (c) Institution, consisting of Student, Teacher, Administrator, Education Specialist, Family, and Community, with a 3×5×6 evaluation structure, resulting in a total of 90 evaluation cells. However, with the dynamic changes in education in the era of technology, the 21st-century global demands, and developments related to the Industrial Revolution 4.0 and Society 5.0, the author proposes further development of this model to make it more relevant in the modern educational context. The method used is a critical analysis and literature review of Hammond's Evaluation Cube (1967), with an emphasis on the relevance of the model to current educational developments. The findings produced are that the author offers an updated model with three main dimensions: (a) Behavior, consisting of Cognitive, Affective, and Psychomotor aspects, (b) Instruction, consisting of Organization, Content, Method, Facilities, and Cost, (c) Institution, consisting of Student, Teacher, Administrator, Education Specialist, Family, Community, AI and Data Specialist, Technology/IT Support, and Policies/Regulations, with a 3×5×9 evaluation structure, resulting in a total of 135 evaluation cells. The implication of this study is that the "Hammond Evaluation Cube Adapted to Current Conditions (2025)" can be a richer and more relevant evaluation model for modern education. This model can help educational institutions identify needs, strengths, and challenges in technology integration and in preparing students for an evolving future.

Keywords: Behavior, Hammond's Evaluation Cube, Industrial Revolution 4.0, Institution, Instruction, Society 5.0

Correspondence
Ryan Angga Pratama
22010040004@mersin.edu.tr

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1. INTRODUCTION

Curriculum evaluation is the process of assessing the effectiveness of the curriculum. Even if the curriculum is well designed, evaluation needs to be done periodically to ensure that the curriculum meets the needs of the community that implements it, and the results of the evaluation must be used in curriculum development. Therefore, curriculum evaluation is very important. In short, curriculum evaluation is the assessment of the effectiveness of the curriculum, and there are various evaluation models, including the Hammond evaluation model which is goal-oriented.

Based on the need to develop evaluation guidelines, Hammond expanded Tyler's curriculum evaluation model into a more detailed one (Guskey, 2000). Although the objective dimension in Hammond's model includes Tyler's ideas, the definition of the instructional and institutional dimensions is more clearly outlined in this model (Alkin & Christie, 2004). The main difference between Tyler's model and Hammond's model is that Hammond added a third dimension to the evaluation approach.

Hammond's model, which consists of 90 cells measuring 3×5×6 units, provides rich information but tends to be complex and time-consuming. However, not all cells need to be evaluated as part of the curriculum evaluation process. In the context of the evaluation objective, relevant cells are considered, while irrelevant cells are ignored, and in-depth evaluation is conducted on the remaining cells (Fitzpatrick, Sanders & Worthen, 2011).

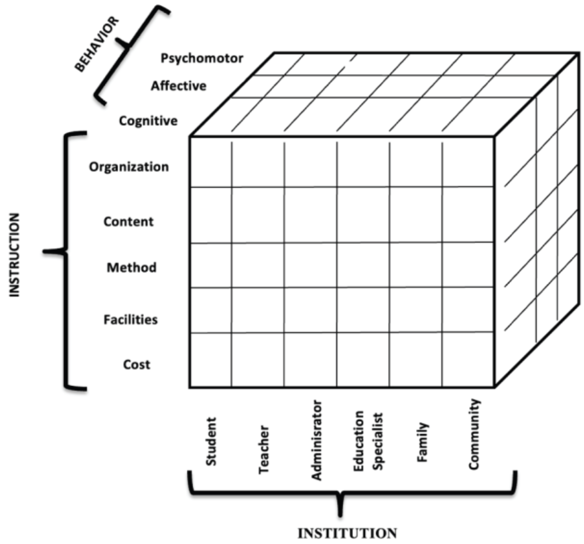

Figure 1. Hammond's Evaluation Cube (1967)

This 3×5×6 cube model results in a total of 90 cells (3×5×6=90), each representing a specific combination of the three dimensions. For example, one cell might focus on "the impact of a particular teaching method (instruction) on changes in student attitudes (behavior) within the context of the school (institution)."

In this model, the evaluation approach is handled holistically, and a comprehensive evaluation is conducted on the three surfaces of the cube and the cells where these surfaces intersect (Hammond, 1967). Therefore, the model can be divided into smaller parts and adapted to the context, but it essentially consists of three basic dimensions: Behavior, Instruction, and Institution.

Dimensions of Hammond's Evaluation Cube Model (1967):

1. **Dimension 3 – Behavior**
   The aspects of behavior that are intended to be changed or improved through the program, including: Cognitive, Affective, Psychomotor.
2. **Dimension 5 – Instruction**
   The elements that make up the learning process, including: Organization, Content, Method, Facilities, Cost.
3. **Dimension 6 – Institution**
   The parties involved or affected by the program, including: Student, Teacher, Administrator, Education Specialist, Family, Community.

Hammond's evaluation approach aims to compare data obtained from students with program objectives, and to assess how effective the program is in achieving previously established objectives (Clark, 1974). This model is truly comprehensive because it involves various elements that interact with each other in the evaluation of educational programs. Referring to Tyler's model (which was developed earlier), the general implementation of Hammond's Evaluation Cube Model (1967) is as follows:

1. Identifying the Focus of the Evaluation: This involves determining the specific aspect of the program to be evaluated. For example, whether the evaluation focuses on the effectiveness of a new teaching method, the program's impact on student motivation, or the efficiency of resource usage.
2. Using the Matrix: In this case, the 3×5×6 matrix can be used to map and analyze the interactions between the three dimensions. Each cell in the matrix can be evaluated separately or in relation to other cells.

3. Data Collection: Appropriate data collection methods must be selected to gather information related to each cell in the matrix. These methods may include observations, surveys, interviews, tests, document analysis, and others.
4. Data Analysis: The collected data is analyzed to identify patterns, trends, and key findings. This analysis may involve quantitative techniques (e.g., descriptive and inferential statistics) and qualitative techniques (e.g., thematic analysis).
5. Interpretation and Reporting: The evaluation findings are interpreted and reported clearly and concisely. The evaluation report should provide specific and actionable recommendations for program improvement.

Furthermore, the author highlights the strengths and weaknesses of this evaluation model. The advantages of Hammond's Evaluation Cube (1967) include:

a. Comprehensive: This model considers various relevant aspects in program evaluation, providing a holistic view.
b. Systematic: The cube structure helps in organizing and analyzing data systematically.
c. Flexible: This model can be adapted to evaluate various types of programs in different contexts.

Meanwhile, the disadvantages of Hammond's Evaluation Cube (1967) include:

a. Complexity: The large number of cells (90) can make the evaluation process complex and time-consuming.
b. Requires Careful Planning: Implementing this model requires thorough planning and sufficient resources.

The original Hammond Evaluation Cube (1967), according to the author, although comprehensive for its time, did not fully address the technological advances and educational paradigm shifts that characterize today's learning environment. The increasing importance of digital literacy, the integration of artificial intelligence into teaching and learning, and the need for a policy framework to support these innovations have created challenges that did not exist when the model was first developed. These challenges require a more nuanced and expanded evaluation framework to ensure that education systems can effectively meet the demands of the 21st century. Therefore, this evaluation model needs to be theoretically critiqued through this paper, because the author himself has not conducted comprehensive empirical research.

2. METHOD

This paper is written using a literature review as the main method to develop and improve the Hammond Evaluation Cube model (1967). This approach aims to evaluate the shortcomings in the Hammond model which originally had 90 evaluation cells, and add elements that are considered relevant and important for the modern (current) educational context. This development is based on literature that identifies developments in 21st century education, technology, and global education policy. In addition, in a critical analysis, the author examines each dimension of the Hammond Evaluation Cube model (1967) and analyzes it in depth to identify areas that are considered less relevant or need further development. For example, in the Institution dimension, the researcher found that the old structure did not include the role of technology and data specialists which are increasingly important in the era of the Industrial Revolution 4.0 and Society 5.0 (Schwab, 2017). Therefore, the researcher added new elements such as AI and Data Specialist and Technology/IT Support.

The development of the model was carried out through an iterative approach, where relevant literature became a reference for each revision. Key literature used includes developments in global education policy, particularly those focused on technology integration in learning (OECD, 2018), as well as literature discussing evaluation in the context of modern education (Stufflebeam, 2000). A review of this literature shows that the Hammond model needs to be expanded from a 90-cell structure to 135 cells, with the addition of new elements in the Institution dimension that are more relevant to the demands of the 21st century. Furthermore, as part of the process of developing the model through the ideas expressed by the author, the author identified literature that discusses 21st century skills, particularly cognitive, affective, and psychomotor skills (Trilling & Fadel, 2009), as well as the need for technology-based learning that includes the integration of artificial intelligence in educational environments. The author uses an exploratory method where literature that is considered to provide less comprehensive perspectives in the original Hammond model is improved by adding evaluation elements that are more relevant to current educational dynamics. In addition, this model has also been further validated through expert consultation, in this case the lecturer who teaches the course "New Trends in Educational Program Evaluation" to ensure practical application or subsequent Research and Development (R & D) studies.

3. CORE DISCUSSION

Hammond's 3×5×6 cube model is indeed a solid framework, but it can certainly be further developed to align with the demands of the times, the rapid technological advancements, and the future context, including 2025 and beyond.

Why does this evaluation model need to be developed? The author has several reasons, including:

a. Changes in the Educational Context: The educational landscape is rapidly changing. The emergence of new technologies, changes in student demographics, and the demands of 21st-century skills require a more adaptive evaluation approach.
b. More Specific Focus: While the 3×5×6 model is comprehensive, it may still lack specificity in capturing certain increasingly important aspects, such as online learning, personalized learning, and competency-based learning.
c. Advances in Evaluation Theory and Practice: The field of evaluation continues to evolve with the emergence of new theories and methods, requiring the cube model to be updated to integrate these developments.

The author proposes several ideas for developing Hammond's Evaluation Cube Model (1967) while still maintaining its basic principles, including:

1. Dimension 3 – Behavior (**remains unchanged, no new elements added**)
   The aspects of behavior that are intended to be changed or improved through the program, including: Cognitive, Affective, and Psychomotor.
2. Dimension 7 – Instruction (**remains unchanged, no new elements added**)
   The elements that make up the learning process, including: Organization, Content, Method, Facilities, and Cost.
3. Dimension 9 – Institution (**3 new elements added**)
   The parties involved or affected by the program, including: Student, Teacher, Administrator, Education Specialist, Family, Community, AI and Data Specialist, Technology/IT Support, and Policies/Regulations.

Thus, Hammond's Evaluation Cube Model (1967), which originally consisted of a total of 90 cells (3×5×6), is now recommended by the author to become 135 cells (3×5×9). The increase from 90 to 135 evaluation cells reflects the addition of critical dimensions in today's educational landscape that were previously overlooked. Furthermore, the addition of AI and Data Specialist and Technology/IT Support reflects the need for in-depth technology support to support data-driven learning and digital infrastructure management in schools (OECD, 2023). AI in education, for example, can help create more adaptive curricula and personalized learning, where traditional evaluations cannot measure the full effects of these technological interventions (Luckin et al., 2016). Meanwhile, the addition of Policies/Regulations is important to ensure that education remains compliant with the evolving legal and ethical standards for the use of technology in the classroom, such as student data protection and the ethical use of AI.

Below in Figure 2 is Hammond's Evaluation Cube adapted to current conditions (author's version).

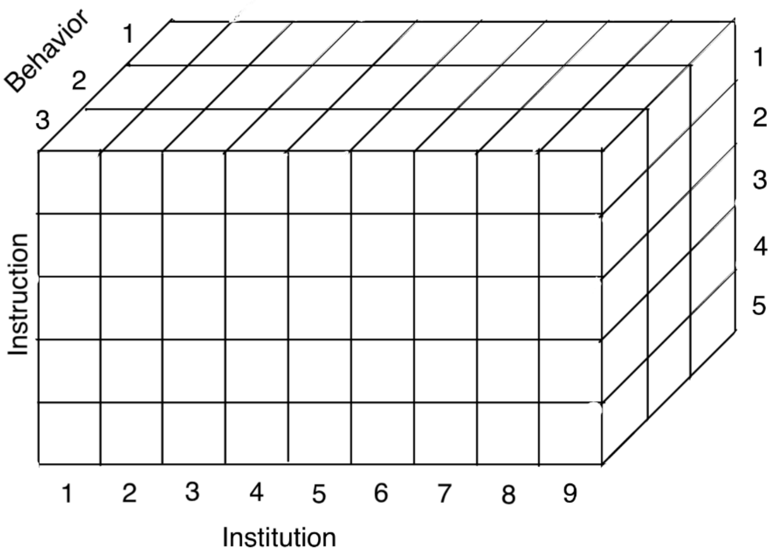

Figure 2. Hammond's Adapted Evaluation Cube (2025)

Why does this result in 135 evaluation structures? Let's break it down step by step. We begin by assigning codes to each dimension. The Cognitive, Affective, and Psychomotor aspects of the Behavior dimension are coded respectively as 3a, 3b, 3c. Next, the Organization, Content, Method, Facilities, and Cost aspects of the Instruction dimension are coded respectively as 5a, 5b, 5c, 5d, 5e. Similarly, the aspects of Student, Teacher, Administrator, Education Specialist, Family, Community, AI and Data Specialist, Technology/IT Support, and Policies/Regulations in the Institution dimension are coded respectively as 9a, 9b, 9c, 9d, 9e, 9f, 9g, 9h, 9i. This is more clearly presented in Table 1 below.

Table 1. Aspects and Their Codes for Each Dimension Hammond's Adapted Evaluation Cube (2025)

Behavior	Instruction	Institution
Cognitive (3a)	Organization (5a)	Student (9a)
Affective (3b)	Content (5b)	Teacher (9b)
Psychomotor (3c)	Method (5c)	Administrator (9c)
	Facilities (5d)	Education Specialist (9d)
	Cost (5e)	Family (9e)
		Community (9f)
		AI and Data Specialist (9g)
		Technology/IT Support (9h)
		Policies/Regulations (9i)

Based on the codes that have been created, we can take an example of the desired evaluation. For instance, we can form an evaluation structure from the combination of 3a, 5a, 9a, or Cognitive, Organization, Student. Similarly, other combinations can be made, such as [3a, 5b, 9a], [3a, 5c, 9a], [3a, 5d, 9a], [3a, 5e, 9a], … [3c, 5e, 9i]. To better understand this evaluation cube, the author will also provide an outline of the stages of conducting an evaluation along with examples. Here is an example of an evaluation in Mathematics education:

1. Cognitive – Content – Teacher (3a, 5b, 9b)

This evaluates students' cognitive abilities, specifically their understanding and application of mathematical knowledge, and how this relates to the content delivered by the teacher. The focus of this evaluation could be, for example, to measure how well the mathematical content presented by the teacher helps students develop problem-solving skills (a part of cognition).

For an evaluator, an observation sheet and interviews can be used to assess how the teacher delivers the mathematical content and how it influences students' cognitive abilities in understanding mathematical concepts.

Observation Sheet (example of some questions/statements):

1) Is the content delivered by the teacher aligned with the current curriculum? (Yes/No)

2) How is the quality of the material presented by the teacher in facilitating students' understanding of mathematical concepts? (Scale 1-5)
3) Does the teacher use a variety of methods to help students deeply understand the concepts? (Always/Often/Sometimes/Never)

Teacher Interview (example of some questions):

1) How do you ensure that students understand the mathematical concepts you teach?
2) What strategies do you use to assess whether students have truly grasped the material?

2. Affective – Method – AI and Data Specialist (3b, 5c, 9g)

Evaluating students' emotional reactions (motivation, attitude) in mathematics learning that uses AI-based teaching methods and data analytics. The focus of this evaluation could be to measure how the use of AI and data analytics-based teaching methods affects students' motivation and emotional engagement (part of the affective domain) in learning mathematics.

A simple example: the teacher uses an AI-based learning application to help students learn mathematics, then assesses whether their interest and motivation in learning mathematics have increased.

As evaluators, we can use student questionnaires, interviews with the school's IT team, and an assessment sheet for the AI-based program used in the school.

Student Questionnaire (example of some questions/statements):

1) Do you feel more motivated to learn mathematics after using the AI-based application? (Strongly Disagree - Strongly Agree)
2) How often do you use this AI platform to study outside of school hours? (Never/Sometimes/Often/Always)

Interview with the IT Team (example of some questions):

1) How was the AI-based application developed or selected to support the learning process at the school?
2) Are there any frequent technical issues when students use the application? How are these issues addressed?

3. Psychomotor – Facilities – Technology/IT Support (3c, 5d, 9h)

Evaluating students' psychomotor skills in using physical or digital tools/software during mathematics lessons, as well as the support provided by facilities and technology that facilitate these skills. The focus of this evaluation could be to measure how facilities like interactive whiteboards or tablets help students develop skills in using technological tools in learning mathematics.

Example: Students use graphing calculators or simulations with mathematics software like GeoGebra during lessons, and the evaluation assesses how well they can use these tools to understand mathematical concepts.

As evaluators, we can use observation sheets for the technology facilities used in mathematics learning and conduct interviews with students and teachers about their experiences using these tools.

Technology Facilities Observation Sheet (example of some questions/statements):

1) Are technological facilities such as computers, graphing calculators, and projectors available in the mathematics classroom? (Yes/No)
2) Are these facilities in good condition and easily usable by students? (Scale 1-5)
3) Is there sufficient technical support when students encounter technical issues while using the tools? (Always/Often/Sometimes/Never)

Teacher and Student Interviews (example of some questions):

1) How do you utilize technological facilities in mathematics learning activities?
2) Do you feel these facilities are helpful in developing students' psychomotor skills?

Thus, it is clear that as assessors, evaluators, or policymakers, the evaluation instruments we use not only assess individual student performance but also the school's policies, facilities, technological support, and the role of teachers and staff in facilitating learning. This evaluation is crucial for providing a comprehensive picture of the overall effectiveness of the mathematics education program and how policies and facilities support the teaching and learning process.

From the examples provided above, the general steps for implementing evaluation using the "Adapted Hammond Evaluation Cube (2025)" are as follows:

1. Identifying Educational Objectives

The evaluation should begin by defining clear educational objectives. In the context of Hammond's Evaluation Cube, for instance, we need to select which aspect of the Behavior dimension will be the focus (Cognitive, Affective, or Psychomotor). For example, if we are evaluating students' cognitive competence in mathematics learning, the evaluation objective is to assess students' understanding of mathematical concepts through the technology used by the teacher. After that, we select the relevant dimension combinations, such as Cognitive-Method-Teacher, to evaluate how the teacher's teaching methods support students' cognitive development. Thus, in this stage, we specify the evaluation objectives into more detailed indicators, such as: "Assessing the extent to which students can solve mathematical problems using technology-based teaching methods, supported by IT facilities at the school."

2. Learning Experience

Once the evaluation objectives are established, the next stage is to identify the desired learning experiences to achieve those objectives. In the context of Hammond's Evaluation Cube, we need to evaluate the learning experiences related to Instruction and Institution. We then choose the appropriate learning experiences to support the development of the selected Behavior dimension (whether Cognitive, Affective, or Psychomotor). For example, if we are evaluating technology-based teaching methods, the expected learning experience is the use of mathematics software by students to understand specific concepts. For instance, students use GeoGebra software to plot mathematical graphs and solve quadratic equation problems. We need to evaluate how the learning experience is organized in the school context. Observe students' engagement in learning using the predetermined methods and how they interact with the teacher and available facilities.

3. Organizing the Learning Experience

The learning experience must be organized systematically to enable students to achieve the established objectives. In Hammond's Evaluation Cube, this means organizing the learning experience based on the given instruction, such as teaching methods and the use of facilities. For example, if our evaluation focuses on Cognitive-Method-Technology/IT Support, ensure that the learning experience involving technology is integrated with the appropriate teaching methods, such as assigning technology-based tasks to students. Ensure that support from teachers, technology/IT staff, and facilities is set up to facilitate the learning experience. We need to use observation sheets to assess how the learning experience is organized and whether it enables students to achieve the desired cognitive or affective objectives. This sheet can also assess students' engagement with the methods and technology used.

4. Evaluating Results

The results evaluation stage involves measuring whether the learning objectives have been achieved. In the context of Hammond's Evaluation Cube, we collect data on how students' behavior has changed according to the established goals. We can use instruments such as cognitive tests, affective questionnaires, psychomotor observation sheets, as well as interviews with teachers and administrators. We also evaluate whether the designed learning experience has helped students achieve their cognitive, affective, or psychomotor goals. If the results do not align with the objectives, identify the obstacles within the learning experience or the organization of instruction. Example: "Student engagement significantly increased when technology was used, but IT support in the school needs to be improved to prevent technical difficulties."

5. Reporting and Recommendations

The evaluation report should present findings related to the achievement of objectives and the success of the learning experience. The report should provide data and analysis on how behavior, instruction, and institution worked together to support student learning outcomes. Example Report Content: "Technology-based teaching methods significantly supported students' cognitive understanding, but IT facilities need improvement to optimize the learning experience."

Based on the evaluation results, specific and actionable recommendations should be provided for improving the organization of the learning experience, teaching methods, or technology support. Example recommendation: "The school needs to provide additional technology training for teachers and upgrade IT infrastructure." Additionally, we should present the evaluation results to school policymakers, teachers, and other staff to discuss how these findings can be used to improve learning at the school.

Figure 3. Stages of Implementing Evaluation Using the Adapted Hammond Evaluation Cube (2025)

Next, in this section, we need to discuss further. The critical question is whether this evaluation model with its new dimensions is relevant and appropriate for current conditions. Below is a detailed explanation of each element from the three dimensions.

A. Behavior Dimension

This dimension addresses the three main domains of human development in education: Cognitive, Affective, and Psychomotor. Together, these represent broader educational goals, which are to develop the intellectual, emotional, and physical skills of students.

1. Cognitive Domain

The cognitive domain focuses on the intellectual and thinking abilities of students. This dimension is rooted in Bloom's Taxonomy (1956), which serves as the foundation for many educational development models. In evaluation, this domain measures students' ability to know, understand, apply, analyze, synthesize, and evaluate information. These competencies are closely related to intellectual knowledge and skills.

As is well-known, the cognitive domain is divided into six levels:

1) Knowledge: Recalling and recognizing basic information such as facts, concepts, and principles. Example: Recalling definitions or historical facts.
2) Comprehension: Understanding the meaning of information without necessarily solving new problems. Example: Explaining concepts in one's own words.
3) Application: Using information or concepts in real-life situations. Example: Applying mathematical theories to solve practical problems.
4) Analysis: Breaking down information into smaller components to understand structure and relationships. Example: Analyzing an argument in an essay.
5) Synthesis: Combining separate elements to create something new. Example: Designing a project plan based on several concepts.
6) Evaluation: Making judgments about the value or quality of information based on specific criteria. Example: Evaluating the quality of artwork or writing.

Evaluations in this domain include written tests, quizzes, or projects that measure students' level of understanding and ability to process information. This is essential for assessing the intellectual abilities that students achieve at each level of education.

According to the author, the behavior dimension in Hammond's Evaluation Cube (1967), which includes the cognitive, affective, and psychomotor domains, remains relevant but needs to adapt quickly to address the challenges arising from the rapidly evolving technological era, Industry 4.0, Society 5.0, and the global demands of the 21st century. We know that Industry 4.0 is marked by technological advancements such as Artificial Intelligence (AI), Internet of Things (IoT), Big Data, robotics, and automation. Similarly, Society 5.0, which is a continuation of Industry 4.0, emphasizes the integration of smart technology with social life to enhance human well-being.

The World Economic Forum's (2020) report also mentions that critical thinking, analysis, and innovation are among the most important skills for the future workforce. The ability to process and critically evaluate information is increasingly required due to the vast volume of information and the complexity of data in the Big Data era. In this context, the cognitive domain must adapt to produce graduates with complex problem-solving skills, critical thinking, digital literacy, and creativity.

2. Affective Domain

The Affective Domain relates to the development of emotions, attitudes, values, and social responses. This domain is organized within a framework of five levels, adapted from the educational taxonomy proposed by Krathwohl, Bloom, and Masia (1964), which focuses on how learners emotionally respond to educational content.

As is known, the affective domain is divided into five levels:

1) Receiving: Awareness or sensitivity to certain phenomena. Learners must be prepared to listen or pay attention to information. Example: Listening to the teacher without distractions.
2) Responding: Active participation in the teaching-learning process with visible engagement. Example: Answering questions or participating in class discussions.
3) Valuing: Developing attitudes or values that are expressed through behavior. Example: Showing appreciation for the value of teamwork in group projects.
4) Organization: Integrating values into a personal value system so that they become part of one's guiding principles. Example: Making integrity a core principle in learning.
5) Characterization: Adopting certain values to the point that they form personal character. Example: Consistently practicing ethical behavior in daily life.

Evaluating this domain is more challenging because it involves non-verbal aspects like attitudes and values. However, evaluation can be done through observation, attitude questionnaires, or student self-reflection on how they view the learning process and the outcomes of the material studied.

Furthermore, according to the author, as it has developed to this day, the behavior dimension in Hammond's Evaluation Cube (1967), which includes the cognitive, affective, and psychomotor domains, remains relevant but needs to quickly adapt to face emerging challenges. For instance, Industry 4.0 and the Society 5.0 era focus on humans as the center of technological development, emphasizing the importance of empathy, emotional intelligence, and the ability to collaborate in an increasingly digital and connected world. In the context of the 21st century, affective development is crucial to prevent problems such as technology addiction or dehumanization in digital interactions. According to Goleman (1996), Emotional Intelligence (EQ) is an important factor in personal and professional success, often surpassing Intellectual Intelligence (IQ) in its influence on social relationships and work. In the modern era, affective skills such as emotion management, social awareness, and adaptability are critical in a world increasingly reliant on technology. Society 5.0 also calls for a balance between technology and human values. Schwab (2017), founder of the World Economic Forum, emphasized that technologies like AI and Big Data must be used carefully to enhance social well-being, not just for economic efficiency. Education must combine technological advancements with the reinforcement of human values, such as empathy and social responsibility.

3. Psychomotor Domain

The Psychomotor Domain encompasses learners' ability to perform physical tasks and motor skills. Its focus is on the development of skills that require physical coordination, bodily movement, and manual dexterity. The theory of the psychomotor domain was further developed by Simpson (1972), who identified seven levels of psychomotor skills, including:

1) Perception: The ability to use sensory organs to identify physical cues and perform necessary movements. Example: Observing someone's movement before attempting it yourself.
2) Set: The mental, physical, and emotional readiness to act. Example: Preparing to begin a physical exercise.
3) Guided Response: Initial skills performed under guidance and supervision, where movements are carried out based on direct instruction. Example: Performing a dance move after being shown by the teacher.
4) Mechanism: Skills that begin to be performed automatically and with confidence, without much guidance. Example: Riding a bicycle smoothly without needing direct instructions.
5) Complex Overt Response: Performing complex physical movements with high coordination. Example: Playing a musical instrument at a high level of difficulty.
6) Adaptation: Adjusting learned skills to new situations. Example: Modifying tennis techniques to adapt to different court conditions.

7) Origination: Creating new movements that have not been learned before. Example: Creating an original dance choreography.

The evaluation of psychomotor skills involves direct observation, skill demonstrations, or practical tests. These evaluations are often conducted in laboratories, sports fields, or art studios to measure the extent to which students master the necessary practical skills.

Furthermore, as with the previous discussion points, the author notes that, as it has developed to the present day, the behavior dimension in Hammond's Evaluation Cube (1967)—which includes the cognitive, affective, and psychomotor domains—remains relevant but must quickly adapt to address emerging challenges. In the Industry 4.0 era, simple manual tasks are increasingly replaced by automation and robotics, but psychomotor skills remain crucial, especially in jobs involving human-machine interaction. For example, skills in operating advanced machines, assembling and programming robots, or using virtual technologies like Virtual Reality (VR) and Augmented Reality (AR) are becoming highly important. Schwab (2017) also emphasized that automation will not completely replace humans; instead, humans will work alongside smart technologies. This requires new technical skills that blend physical and digital abilities. In education, these psychomotor skills must be facilitated through technology-based labs, simulations, and direct technology-based instruction.

In the global 21st-century context, the interaction between the cognitive, affective, and psychomotor domains is more important than ever. Education in the 21st century cannot focus on just one domain. 21st-century skills combine aspects of all three domains to shape individuals who are intellectually competent, socially empathetic, and technically skilled. As is known, some of the key 21st-century skills, according to the Partnership for 21st Century Skills (2009), include: Critical Thinking and Problem Solving (related to the cognitive domain), Collaboration and Communication (related to the affective domain), and Creativity and Innovation (related to both the cognitive and psychomotor domains). These skills must be developed simultaneously to prepare students for the increasingly complex world of work and social life.

So, what can we conclude about this dimension?

In facing the era of Industry 4.0, Society 5.0, and the global demands of the 21st century, the Behavior Dimension in Hammond's Evaluation Cube (1967) must continue to adapt to new developments. The cognitive domain needs to focus on digital literacy, critical thinking, and analytical skills. The affective domain should support emotional intelligence and social awareness in the context of increasingly dominant technology. Meanwhile, the psychomotor domain should develop the technical skills required to operate advanced technologies. Hammond's Evaluation Cube (1967) remains an essential foundation for evaluating education in this rapidly changing era. With proper adaptation, the behavior dimension can support learners in becoming individuals who are prepared to face today's global challenges. Referring to this, the author believes that the three elements of the behavior dimension do not require significant additions; however, in the evaluation process, we need to highlight more specific points that are part of these three elements. For instance, digital literacy, which is part of both cognitive and psychomotor domains; character education or social-emotional learning (SEL), which is part of the affective domain; critical thinking and metacognition, which are part of the cognitive domain; and the 4Cs (Communication, Collaboration, Critical Thinking, Creativity), which are also part of all three behavior elements, among others.

B. Instruction Dimension

This dimension involves five key elements that shape the structure and success of an educational program, namely Organization, Content, Method, Facilities, and Cost.

1. Organization

In the context of education, organization refers to how teaching is structured and managed, including curriculum planning, class scheduling, and the management of human and technological resources. Effective organization ensures that the learning process runs smoothly and that students can effectively engage in their learning. Goodlad (1979) emphasized the importance of having a solid structure in education. A systematically organized curriculum helps both teachers and students follow the learning flow clearly and supports student engagement. Evaluation strategies for organization include assessing whether the curriculum and schedule are structured effectively and measuring how resources are managed to support learning efficiently.

2. Content

Content refers to the material taught to students. Evaluating content involves measuring its relevance, depth, and how well it reflects current developments and prepares students for 21st-century challenges. According to Trilling and Fadel (2009), 21st-century educational materials should integrate critical thinking, creativity, and collaboration skills. Additionally, content must be relevant to future needs, including digital literacy and adaptive thinking skills, which are crucial in the global era. Evaluation strategies for content include assessing whether the learning content is relevant to contemporary needs and supports 21st-century skills, as well as evaluating the alignment of the subject material with national and international curriculum standards.

3. Method

Method refers to the approaches or techniques teachers use to instruct students. One well-known and widely implemented method in modern education is Project-Based Learning (PBL). In this approach, students learn by completing projects that help them develop critical thinking and real-world problem-solving skills. Thomas (2000), in his review of Project-Based Learning, concluded that this method is highly effective in enhancing student engagement and problem-solving abilities. Additionally, Blended Learning, which combines face-to-face learning with online technology, has gained traction in modern education. Horn and Staker (2014) emphasized that blended learning allows for personalized learning and greater access to digital resources. Evaluation strategies for methods include assessing the effectiveness of teaching methods in improving student engagement and determining how well the methods used help students achieve learning objectives.

4. Facilities

Facilities include the infrastructure and resources that support the learning process, such as classrooms, laboratories, libraries, technology, and access to digital devices. Additionally, software applications, educational videos, and various educational features like online learning environments are also facilities in the current era. Adequate facilities ensure that students have access to the resources they need to support their learning. As Fox and Jones (2016) highlighted, access to educational technology, including the internet and digital devices, is crucial for supporting student engagement and learning outcomes in the modern era. These facilities include hardware such as computers, as well as software and educational platforms that enable collaborative and online learning. Evaluation strategies for facilities include measuring the availability and quality of physical and technological facilities, as well as assessing whether the provided facilities meet the needs of modern learning, including access to digital technology.

5. Cost

Cost in education refers to the budget and expenditures used to provide educational services. Evaluating cost involves analyzing how the budget is utilized to achieve learning objectives efficiently. Levin and McEwan (2001) emphasized the importance of cost-benefit analysis in education to ensure that resources spent yield optimal learning outcomes. This analysis is particularly important in the context of spending on educational technology, which often requires significant investment. Evaluation strategies for cost include assessing cost efficiency in the procurement of educational technology and supporting infrastructure, as well as comparing the cost-effectiveness of different educational programs to find the most efficient solutions.

So, what can we conclude about this dimension?

The Instruction Dimension in Hammond's Evaluation Cube (1967) originally involved five key elements: Organization, Content, Method, Facilities, and Cost. Each of these elements must be evaluated thoroughly to ensure that education is carried out effectively and efficiently. By ensuring an organized curriculum, innovative teaching methods, adequate facilities, and controlled costs, educational institutions can provide optimal outcomes for students and society.

In the face of Industry 4.0, Society 5.0, and the global demands of the 21st century, the Instruction Dimension in Hammond's Evaluation Cube (1967) must adapt to current challenges. Therefore, the author suggests highlighting two additional important elements rather than adding completely new ones, as they are closely related to the existing five elements. These two elements are Personalized Learning and Lifelong Learning. According to the author, although personalized learning is almost synonymous with or an inseparable part of teaching methods, it needs to be highlighted and given special attention. As is well-known, personalized learning, supported by technologies like Artificial Intelligence (AI) and adaptive learning systems, has become a new trend. These systems allow learning content and methods to be tailored to the needs, abilities, and preferences of each student. This is becoming increasingly important in the context of data-driven learning, where algorithms are used to customize the learning experience for each individual.

Similarly, lifelong learning is becoming more crucial amid rapid global changes and technological disruption. Lifelong learning ensures that individuals acquire skills that meet the demands of the labor market and social dynamics. The development of technologies such as AI, automation, and digital transformation requires society to continually learn and adapt. Lifelong learning enables individuals to continuously improve their skills, ensuring that they remain relevant and competitive in the workforce. Additionally, this approach strengthens their capacity to adapt to technological, social, and economic changes. Programs such as online training, microlearning, and flexible, needs-based recertification are also important components of lifelong learning strategies in various countries, as promoted by organizations like OECD and UNESCO.

C. Institution Dimension

This dimension involves nine (previously six) elements that focus on various stakeholders in the education process, including Students, Teachers, Administrators, Education Specialists, Families, Communities, AI and Data Specialists, Technology/IT Support, and Policies/Regulations. Of course, each actor has an important role in supporting and influencing the success of education. This dimension is relevant in evaluating how educational institutions interact with stakeholders to achieve learning goals.

1. Student

Students are the primary actors in the education system, and any form of educational evaluation must begin with understanding their needs, aspirations, and achievements. The role of students in active learning, engagement, motivation, and academic development is crucial to assess. Evaluating the student dimension involves examining how students participate in the learning process and how well they develop across the cognitive, affective, and psychomotor domains.

Self-regulated learning is one concept often associated with student evaluation. Zimmerman (2002) defines self-regulated learning as the ability of students to manage their learning goals, monitor progress, and regulate the strategies necessary to achieve those goals. This approach is essential to ensure that students are not merely passive recipients but also active participants in the learning process. Evaluation strategies for students include measuring their engagement in class and learning activities, assessing academic and non-academic skills, such as social and emotional skills, and evaluating their mastery of the material through formative and summative tests and assessments.

2. Teacher

Teachers are one of the most critical components in the success of education. Their role goes beyond delivering content; they facilitate learning, motivate students, and create an environment that supports both academic and personal development. Teachers also play a key role in adopting teaching innovations, such as project-based learning and blended learning, which are increasingly relevant in the technological era. According to Hattie (2009), in his meta-analysis of factors influencing student learning outcomes, teachers have the greatest impact on student achievement. This encompasses various aspects, from teaching skills and relationships with students to expertise in using effective teaching strategies. Evaluation strategies for teachers include assessing the teacher's effectiveness in delivering content and motivating students, measuring the teacher's ability to adopt innovative teaching methods and technology, and evaluating the relationship between the teacher's teaching skills and student learning outcomes.

3. Administrator

School administrators play a role in managing operations, policies, and educational resources. They are responsible for ensuring that the school runs smoothly and supports the achievement of learning goals. This includes financial management, policymaking, and relationships with the community and other stakeholders. Fullan (2007) emphasizes the importance of transformative leadership from school administrators in creating positive changes in schools. According to him, effective administrators are those who can inspire teachers and staff, lead innovation, and create a positive school culture. Evaluation strategies for administrators include assessing the effectiveness of resource management and school policies, measuring their ability to create and maintain a school environment that supports learning, and evaluating their leadership in promoting innovation and collaboration among stakeholders.

4. Education Specialist

Education specialists include counselors, curriculum experts, teacher trainers, and other education professionals focused on developing specific skills and supporting students with special needs. They play a role in designing learning programs, supporting the improvement of teaching quality, and providing additional support to students who need it, such as those with special needs or learning difficulties. Deshler and Schumaker (2006) highlight the importance of education specialists in providing learning strategies designed to assist students with limitations. They also help ensure that the curriculum is accessible to all students, regardless of learning differences. Evaluation strategies for education specialists include measuring their contribution to supporting teachers and students, particularly students with special needs, assessing the success of intervention programs designed to help students overcome learning barriers, and evaluating the specialists' involvement in designing and developing an inclusive curriculum.

5. Family

Families play a crucial role in supporting a child's education, both directly through involvement in learning and indirectly by providing emotional and social support. According to Epstein (2001) in her model of family involvement, there are six types of involvement that families can engage in regarding their child's education: parenting, communication, volunteering, learning at home, decision-making, and collaborating with the community. This involvement is not limited to the home but also includes the relationship between families and schools. Evaluation strategies for families include assessing the level of parental involvement in school activities and support for learning at home, measuring the impact of family involvement on students' academic achievement and emotional well-being, and evaluating the school's efforts to engage families as partners in their child's education.

6. Community

The community, which includes the social and economic environment surrounding the school, plays an important role in supporting education. Collaboration between schools and communities can enrich students' learning experiences by providing additional resources, such as support from non-governmental organizations, local agencies, or companies. Research by Warren et al. (2005) shows that community-based partnerships between schools and communities can help address educational disparities, especially in areas with limited resources. This collaboration allows schools to tap into local resources and strengthen the relationship between students and the community.

Evaluation strategies for communities include assessing the collaboration between schools and communities in supporting education and social development, measuring the participation of community organizations in supporting educational and extracurricular programs, and evaluating the impact of community involvement on student learning outcomes and social development.

7. AI and Data Specialist

Although this role is similar to that of an Education Specialist, it is more focused on the field of technology, where the role of AI and Data Specialists is increasingly important in modern education. With the growing use of artificial intelligence (AI) and data analytics to personalize learning, improve academic outcomes, and optimize educational management, this role is becoming more specialized. These specialists are responsible for developing, implementing, and maintaining systems that utilize big data and AI algorithms to analyze student performance, provide personalized feedback, and help schools optimize their operations.

The fundamental theories in this field are Learning Analytics and Educational Data Mining, which aim to understand patterns in educational data to enhance learning and make data-driven decisions. Long and Siemens (2011) explain that learning analytics enables educators to gain insights into student engagement and performance, allowing for personalized learning and timely interventions. The role of AI and data specialists is also crucial in ensuring that AI systems operate in accordance with ethical principles such as fairness, transparency, and accountability. Furthermore, Selwyn (2019) emphasizes that the application of AI in education must be overseen by professionals who understand the ethical and social implications of the technology, to prevent bias or inequality. Evaluation strategies for AI and data specialists include assessing the effectiveness of AI systems and data analytics in personalizing learning and improving student academic outcomes, evaluating the specialists' ability to manage big data ethically, safely, and in compliance with regulations, and examining how data usage supports evidence-based educational decisions.

8. Technology/IT Support

Technology/IT Support is a crucial component of modern education, responsible for ensuring that the technology used in the learning process and school operations functions properly. This includes supporting network infrastructure, hardware and software, and helping to resolve technical issues faced by teachers, students, and administrative staff. As digital transformation in education accelerates, IT support becomes increasingly important to ensure the smooth operation of educational systems. Bebell and O'Dwyer (2010) and Ertmer et al. (2012) share the same view that technology in the classroom can support pedagogical innovation and improve student learning outcomes when backed by solid infrastructure and adequate technical support. They emphasize that effective technology support is not limited to providing hardware and software but also ensuring that teachers have easy access to technical assistance to resolve any technological issues that may arise during the learning process.

Additionally, a report by the International Society for Technology in Education (ISTE, 2017) states that responsive IT support plays a key role in integrating technology into the curriculum, which enhances student engagement and facilitates more dynamic and interactive learning. Reliable technology support helps maintain access to online learning systems, learning management systems, and other tools used in schools. Technology/IT Support is an integral part of modern educational institutions, supporting the technology infrastructure, software, and digital services used in the learning and educational management processes. With the ongoing digital transformation in education, IT support is essential to ensure that technology tools run smoothly, internet access is reliable, and technical issues are promptly addressed.

Evaluation strategies for Technology/IT Support include assessing the reliability and responsiveness of technical support in resolving issues faced by students and staff, evaluating the availability of technology infrastructure, including networks, software, and cybersecurity, and examining how technology support contributes to the smooth operation of online learning and digital infrastructure.

9. Policies/Regulations

Policies and regulations are essential elements that guide and govern the educational system at local, national, and international levels. Educational policies set operational standards, curriculum frameworks, and accountability measures, while directing innovation and change within the education sector. Policies also play a role in ensuring that the education system meets the needs of all students fairly and in accordance with existing legal frameworks.

Educational policies emphasize that strong regulations must support equitable access to education and ensure quality across the educational system. Ball (2006) stated that educational policies reflect the underlying social, political, and economic values of society. Robust policies should be able to adapt to technological and social changes while maintaining the core goals of education, which are to create a knowledgeable and just society. Additionally, policies related to the use of technology and data in education are crucial for protecting student privacy and rights. Livingstone and Bulger (2014) highlighted the importance of strict regulations governing the use of student data, especially in technology-based education environments, to prevent misuse of personal information and ensure compliance with privacy laws.

Evaluation strategies for policies/regulations include assessing schools' compliance with national and local education policies, including curriculum and learning standards, measuring the effectiveness of regulations related to data security, privacy, and technology use in education, and evaluating the flexibility of policies in responding to social, technological, and economic changes affecting education.

So, what can we conclude about this dimension?

The Institution Dimension in Hammond's Evaluation Cube (1967) originally included six key elements: Student, Teacher, Administrator, Education Specialist, Family, and Community. In facing the Industry 4.0 era, Society 5.0, and the global demands of the 21st century, the Institution dimension in Hammond's Evaluation Cube (1967) must naturally adapt to the challenges ahead. Therefore, the author has added three important elements that are closely related to the previous five: AI and Data Specialist, Technology/IT Support, and Policies/Regulations. With rapid technological developments, educational institutions require stronger IT Support. Technology/IT Support is crucial for the smooth operation of schools in the digital era. With the increasing use of technology in learning—such as Learning Management Systems (LMS), stable internet access, and the hardware and software used in classrooms—technical support becomes the backbone that ensures there are no disruptions in the learning process. Similarly, the growing use of big data and AI in education means that institutions may need to collaborate with AI and data specialists to develop more accurate and personalized data-driven evaluations. Finally, overseeing all these aspects are the policies/regulations that guide and govern the educational system at the local, national, and international levels.

The findings of this paper indicate that the addition of new dimensions in Hammond's Evaluation Cube (1967) model provides a more comprehensive view of educational evaluation in the modern context. The increase in the number of evaluation cells from 90 to 135 reflects the new reality in education, where technology and educational policies play an increasingly important role in regulating the learning process and student learning outcomes. This is in line with recent studies showing that the integration of artificial intelligence (AI) and data-driven learning can enrich educational evaluation by providing deeper insights into the effectiveness of the learning process (Luckin et al., 2016). The addition of elements such as AI and Data Specialist, Technology/IT Support, and Policies/Regulations in the Institution dimension is expected to support digital literacy and 21st century competencies (Trilling & Fadel, 2009). In general, these findings are expected to be in line with the global trend towards digitalization in education. However, the results also show a high level of heterogeneity in how institutions adopt these technologies, which may be due to differences in access to technology across countries and regions (OECD, 2018). In addition, these findings indicate that modern education requires more flexible evaluation models, which can be adapted to local and global needs.

Furthermore, the author's thoughts expressed through this paper also strengthen the findings of previous studies which state that the Hammond Evaluation Cube model (1967) is a very flexible tool for evaluating the dimensions of behavior, instruction, and institutions in education (Stufflebeam, 2000). However, compared to the original version of this model, the author introduces a more modern adaptation by adding AI and Data Specialist, Technology/IT Support, and Policies/Regulations to the Institution dimension. Comparison with previous studies such as those conducted by Zhao (2015) shows that models that focus more on traditional elements such as instruction and behavior are no longer sufficient to address modern demands, where digital literacy and technological infrastructure play a key role. The main difference in this thinking is the emphasis on technology-based evaluation, which has not been widely explored in research on the Hammond model. For example, a study by Karagöl and Adıgüzel (2022) from Türkiye examined the affective domain (behavior dimension), organization, content, methods (instruction dimension), students, teachers, administrators (institution dimension). Likewise, a study by Altay and Saracaloğlu (2022) which examined the cognitive, affective, psychomotor domains (behavior dimension), organization, content, methods, facilities (instruction dimension), students, teachers (institution dimension) to evaluate the 9th grade English curriculum in 7 schools in Aydın province, Türkiye in the 2015-2016 academic year. A study in the Philippines was conducted by Tenedero and Pacadaljen (2021) which examined the cognitive, affective, psychomotor domains (behavior dimension), content, methods (instruction dimension), students, teachers, families, administrators (institution dimension). Also, three studies in Indonesia, namely a study by Prastati (2011) using the CIPP evaluation model combined with the Hammond Evaluation Cube, a study by Khaidir (2015) which examined the cognitive, affective, psychomotor domains (behavior dimension), content, methods, facilities, funds (instruction dimension), teachers, administrators, education specialists (institution dimension), and a study by Nur (2018) which examined the cognitive, affective, and psychomotor domains (behavior dimension), organization, content, methods (instruction dimension), students (institution dimension).

Throughout the author's research, there are indeed not many studies conducted related to this evaluation model. According to the author, not only are the evaluation models that are more famous and have many literature studies such as CIPP, Tyler, UCLA Evaluation Model, Provus Discrepancy, Eisner, Stake, Metfessel-Michael, or Scriven; but the Hammond Evaluation Cube is also worthy of consideration for educators, policy makers, supervisors, assessors, or researchers to use, especially if it focuses on evaluation based on learning outcomes and instructional effectiveness by considering technology infrastructure as a new evaluation domain that is relevant to the context of modern education. Thus, with additional dimensions such as AI and Data Specialist, Technology/IT Support, and Policies/Regulations in the Hammond Evaluation Cube Adjusted to Current Conditions (2025), this model allows educational institutions to evaluate how technology is applied in the classroom and how student data is analyzed to improve learning outcomes. For example, institutions can use this model to evaluate the effectiveness of data-driven learning programs, ensuring that adequate technology support is available to support these initiatives. In addition, for educators, this model can help evaluate the extent to which technologies such as AI are used to support personalized learning, as well as their impact on student engagement and academic outcomes (Luckin et al., 2016). Meanwhile, for policy makers, the adaptation of this model provides a clear framework for assessing whether educational policies related to digital technology and data protection have been properly implemented at the institutional level. From here, the author also recommends further research related to the presentation of this paper, including exploring how the Hammond Evaluation Cube Adapted to Current Conditions (2025) can be adapted or conducting Research and Development (R&D) so that the results are empirically proven. Not only that, future research can also include case studies on the application of this adapted model in schools with different technological infrastructures, so that it can identify factors that influence the success of implementation and obtain a more comprehensive picture of the evaluation according to the objectives expected by the evaluator.

4. CONCLUSION

In the original model of Hammond's Evaluation Cube (1967), educational evaluation focused on three main dimensions: Behavior, Instruction, and Institution, with an evaluation structure of 3×5×6, resulting in a total of 90 evaluation cells. This development took a comprehensive approach to various aspects of education through 90 different perspectives. However, with the dynamic changes in education in the technological era, the global demands of the 21st century, and developments related to Industry 4.0 and Society 5.0, the author proposes further development of this model to make it more relevant to the context of modern education.

Following development through a critical analysis and literature review, the model has evolved from 3×5×6 to 3×5×9, with a total of 135 evaluation cells, encompassing various important aspects relevant to current developments. The author assumes that the development of this evaluation model reflects a response to the challenges of 21st-century education, where social, technological, and economic changes require a more integrated and comprehensive approach to evaluating educational effectiveness. This "Hammond's Evaluation Cube Adapted to Current Conditions (2025)" makes the evaluation model richer and more relevant to modern education. By expanding the Institution Dimension, the author offers a more ready-to-use evaluation tool that can address the technological, social, and economic changes affecting education now and possibly in the future. Furthermore, practically, this model also provides a "tool" for educators, policy makers, or institutions to conduct a more comprehensive assessment of the education system. By combining the dimensions of technology and policies, this model allows stakeholders to evaluate not only instructional results but also the framework of infrastructure and regulations that support modern education. This model can help in the decision making process related to the adoption of new technology, the implementation of learning tools driven by AI, and alignment of educational practices with current policy requirements.

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