

Research

From TES (Techne, Episteme, Sophia) to STEAM: A Note

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Abstract:

This paper argues that contemporary STEAM education (Science, Technology, Engineering, Arts, Mathematics), while widely studied in pedagogical and policy terms, lacks a deeper epistemic foundation. It proposes the ancient Greek framework of Techne, Episteme, and Sophia (TES), drawn from Plato and Aristotle, as a philosophical structure for understanding STEAM. The author reconstructs TES as a dual-axis model: a vertical axis of cognitive depth (from practical skill, to theoretical knowledge, to reflective wisdom) intersecting with the horizontal axis of STEAM disciplines. This model suggests that all STEAM fields operate simultaneously across all three levels, yet modern education tends to prioritize techne and episteme while neglecting sophia—wisdom concerning the good of the whole. Through examples in medicine, architecture, and artificial intelligence, the paper shows how TES helps address ethical and governance questions that purely technical frameworks cannot resolve. It also revisits educational ideas in Plato and Aristotle to compare approaches to curriculum and formation. The paper concludes that TES is a useful analytical tool for rethinking education's purpose and structure, and proposes extending it to a four-part framework—Techne, Episteme, Phronēsis, and Sophia (TEPS)—as a direction for future research.

Keywords: Techne; Episteme; Sophia; STEAM; Plato; Aristotle

1. Introduction

This paper presents a brief overview of a recent larger study of Papanikos (2026) which examines how ancient Greek philosophy can help explain and strengthen modern educational models, especially STEAM, which stands for Science, Technology, Engineering, Arts, and Mathematics. STEAM has become an influential framework because it promotes interdisciplinary learning, creativity, innovation, and problem-solving. However, this study argues that modern educational systems often focus mainly on technical ability and measurable outcomes while paying less attention to the deeper purpose of knowledge and the ethical responsibilities that come with it. For this reason, the study turns to the ancient Greek framework of TES: *Techne*, *Episteme*, and *Sophia*.

Rather than presenting TES and STEAM as opposing systems, the study suggests that they should be understood as complementary. STEAM identifies important academic and professional disciplines, while TES explains different forms or levels of knowledge that can exist within any discipline. Through this combination, education can move beyond training students only to perform tasks and instead help them become thoughtful, responsible, and wise contributors to society.

2. The Meaning of TES

The first concept in the framework is *techne*. In ancient Greek thought, *techne* refers to practical skill, craft, or the ability to make and do things effectively. It is knowledge expressed through action and experience. In the modern world, *techne* can be seen in engineering design, coding, laboratory techniques, medical procedures, architecture, and artistic production. It answers the question of how something is done.

The second concept is *episteme*, meaning theoretical or scientific knowledge. *Episteme* is concerned with explanation, reasoning, and truth that can be demonstrated or justified. Mathematics, scientific laws, economic theories, and philosophical arguments all belong to this category. While *techne* focuses on practice, *episteme* focuses on understanding why things work and what principles govern them.

The third and highest concept is *sophia*, usually translated as wisdom. *Sophia* goes beyond skill and beyond information. It involves sound judgment, reflection on values, awareness of consequences, and orientation toward the common good. Wisdom asks not only whether something can be done, but whether it should be done. It connects knowledge with ethics and human flourishing.

According to this study, one of the greatest weaknesses of many modern systems is that they emphasize *techne* and *episteme* but neglect *sophia*. Students may graduate with strong technical skills and specialized knowledge, yet still lack the ability to use those abilities responsibly.

3. TES and STEAM as Complementary Models

A central argument of the paper is that TES and STEAM operate on different dimensions. STEAM describes fields of study, whereas TES describes forms of knowing. When combined, they create a richer educational model in which each discipline can contain skill, theory, and wisdom (Table 1).

In science, students need practical research methods and laboratory competence, which belong to *techne*. They also need theories, evidence, and logical explanation, which belong to *episteme*. Yet science also raises questions about environmental responsibility, human experimentation, and the social use of discoveries. These concerns require *sophia*.

The same pattern appears in engineering. Engineers must know how to build systems and solve technical problems, but they must also understand mathematics, materials, and physical principles. Beyond this, they need wisdom to consider safety, sustainability, accessibility, and the long-term effects of their designs on society.

The arts provide another example. Artistic creation requires technique and discipline, but it also includes theory, history, and criticism. At the highest level, art invites reflection on beauty, meaning, identity, and the human condition. In this sense, the arts naturally connect all three dimensions of TES.

Table 1. TES–STEAM Matrix (Analytical Projection).

	Science	Technology	Engineering	Arts	Mathematics
Techne	Experimental practice and instrumentation	Tool-building, coding, and system implementation	Design, fabrication, and construction practices	Craft, performance, and material production	Symbolic computation, algorithmic technique, and formal proof
Episteme	Theoretical modelling of natural laws and causal explanation	System architecture, design principles, and technical knowledge	Formal design theory, optimization, and structural analysis	Art theory, aesthetics, and critical interpretation	Abstract structures, formal systems, and logical foundations
Sophia	Discernment of what scientific knowledge means for the good as a whole	Responsible innovation and the governance of technological power for the good as a whole	Design for the Good and the human consequences of built systems	Cultivation of meaning, beauty, and shared human understanding	Reflection on the nature of truth, infinity, and the limits of formal reasoning

This model shows that no discipline should be reduced to technical training alone. Every field benefits when practice, theory, and wisdom are developed together.

4. Applications in Professional Life

The relevance of the TES framework becomes even clearer in professional contexts such as medicine, architecture, and artificial intelligence.

In medicine, doctors and nurses need practical competence in diagnosis, treatment, and procedures. They also depend on scientific knowledge of anatomy, disease, and pharmacology. However, healthcare constantly involves ethical choices: fairness in access to treatment, respect for patient autonomy, end-of-life decisions, and compassionate care. Technical success without wisdom would be insufficient.

Architecture also reflects the three dimensions. Architects require practical design skills and knowledge of construction methods. They must understand engineering principles, materials, and spatial planning. Yet buildings also shape communities, influence daily life, and express cultural values. A structure may be efficient and safe, but if it ignores human needs or destroys the surrounding environment, it lacks wisdom.

Artificial intelligence may be the most urgent modern example. AI depends on programming expertise and advanced scientific knowledge, but its development also raises serious concerns about privacy, bias, accountability, employment, and the future relationship between humans and machines. This study emphasizes that responsible AI cannot be achieved through technical progress alone. It also requires ethical reflection and wise governance.

5. Plato, Aristotle, and the Purpose of Education

The paper also draws on the educational ideas of Plato and Aristotle. Plato viewed education as a journey from opinion toward truth and ultimately toward the Good. In his ideal system, subjects such as mathematics and dialectic trained the mind for higher understanding. Education was not simply preparation for work, but preparation for wise leadership and just citizenship.

Aristotle offered a more practical and empirical perspective. He accepted the importance of skill, scientific knowledge, and wisdom, but he also emphasized *phronesis*, or practical wisdom. *Phronesis* is the ability to make good decisions in concrete situations where rules alone are not enough. This idea is especially valuable in modern professions, where individuals must respond to uncertainty, complexity, and competing values.

For this reason, the study suggests expanding TES into TEPS: *Techne*, *Episteme*, *Phronesis*, and *Sophia*. Such a model recognizes that education should not only teach knowledge and ideals, but also cultivate judgment in real-life situations.

6. Implications for Modern Education

The study offers important lessons for schools and universities today. First, wisdom should not be isolated in a single ethics course. Instead, ethical reflection and social responsibility should be integrated into every discipline. Second, curricula should balance practical training with theoretical depth, so that students understand both how to act and why they act. Third, professional education should include mentorship, case studies, and reflective practice in order to develop judgment. Finally, education should prepare learners not only for employment, but also for citizenship, cooperation, and responsible participation in a rapidly changing world.

7. Conclusions

This paper demonstrates that ancient Greek thought remains highly relevant to contemporary education. STEAM provides an important map of modern disciplines, but TES offers a deeper understanding of what it means to know. Skill and scientific knowledge are essential, yet they are incomplete without wisdom. In an age shaped by technological change and global challenges, societies need citizens and professionals who can think critically, act competently, and judge wisely. The integration of TES and STEAM therefore offers a stronger vision of education for the future.

Reference

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