

# TECHNICAL

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## Technical

**Primary Disciplinary Field(s):** Technology, Engineering, Vocational Studies, Cognitive Psychology, Epistemology

### 1. Core Definition

The term **technical** fundamentally describes that which pertains to specialized knowledge, specific abilities, or particular methods required for the execution of complex tasks within a defined domain. This specialization implies a depth of understanding and precision that exceeds generalized knowledge, often necessitating extensive training and practical experience. In this context, a technical skill is not merely an aptitude but a refined capability--a mastery of tools, processes, or intellectual frameworks necessary to achieve predictable, measurable outcomes. The technical domain is characterized by its rigorous demands for accuracy, adherence to protocols, and the efficient application of established scientific or engineering principles. This scope covers everything from intricate manual dexterity required in surgical procedures to the abstract computational methods utilized in advanced data analytics, emphasizing the dedicated pursuit of methodological excellence over broad conceptual familiarity.

Furthermore, **technical** frequently designates abilities and skills rooted specifically in technology, industrial production, or mechanical systems. This usage connects the concept directly to the application of science in practical ways, focusing on the construction, operation, maintenance, and repair of physical or digital artifacts. Technical fields such as engineering, manufacturing, and information technology rely heavily on reproducible steps and quantifiable metrics. For instance, the development of a complex industrial machine requires highly technical knowledge regarding material science, thermodynamics, and control systems. Similarly, developing software architecture demands specific technical proficiency in programming languages, algorithms, and system integration. This dimension of the term underscores its association with the modern industrialized and computerized world, where efficiency and functional design are paramount objectives driven by applied, specialized methods.

The third critical dimension of **technical** relates to designating scientific specialization or defining a particular aspect of personality or communication style. When describing a communication style as technical, it implies a reliance on precise jargon, nomenclature, or highly formalized language, often requiring prior knowledge from the recipient to ensure comprehension. Conversely, when applied to a person, it often signifies a profound dedication to a narrow field of scientific or professional inquiry--a specialization that defines their professional identity. This technical personality is often associated with analytical rigor, attention to detail, and a preference for systematic problem-solving over abstract philosophical exploration. The synthesis of these definitions reveals that **technical** represents both the specialized content (the knowledge itself)

and the specialized approach (the methodology and mindset) used to handle complex, applied challenges.

An essential characteristic of technical knowledge is its necessary translation into actionable documentation. Documents such as **technical manuals**, engineering specifications, or standard operating procedures (SOPs) serve as critical repositories for codifying this specialized expertise. These artifacts ensure that the knowledge is transferable, teachable, and reproducible across different practitioners and timelines. Unlike purely theoretical knowledge, which may prioritize intellectual novelty, technical knowledge prioritizes utility, reliability, and demonstrable effectiveness in achieving practical goals. The clarity and precision required in drafting these materials--such as the example of "The technical manual will be four pages long"--highlight the pragmatic and structured nature inherent to the technical domain.

## 2. Etymology and Historical Development

The origins of the term **technical** can be traced back to the ancient Greek word, *technē* (τέχνη), which signifies art, skill, or craft. In antiquity, *technē* encompassed both artistic creation and practical mastery, suggesting a systematic method of doing or making something that relied on expertise and codified knowledge rather than mere chance or brute force. Philosophers like Aristotle contrasted *technē* with *epistēmē* (theoretical knowledge or understanding), positioning technical skill firmly in the realm of productive activity. This early distinction established the long-standing differentiation between theoretical contemplation and applied, practical competence, shaping how modern societies categorize specialized labor and instruction. Initially, technical proficiency was heavily embodied in master craftsmen--builders, smiths, and artisans--who possessed proprietary knowledge passed down through apprenticeships rather than formalized academic instruction.

The concept underwent significant transformation during the Industrial Revolution, as human skill began to interact fundamentally with mechanized processes. The complexity of new machinery and industrial systems necessitated a new class of specialized experts--engineers and industrial mechanics--whose skills were formalized and documented. This period saw the institutionalization of technical education, moving technical knowledge out of the guild system and into universities and polytechnic institutes. The emergence of standardized parts, complex factory operations, and large-scale infrastructure projects required technical expertise that was highly transferable and verifiable, moving away from subjective "art" toward objective "science." The skills became increasingly associated with the underlying principles of physics and chemistry necessary to design, operate, and maintain these new technological systems.

In the 20th and 21st centuries, the definition of **technical** broadened considerably with the proliferation of scientific specialization and the digital revolution. Technical expertise is no longer

confined solely to mechanical or industrial contexts; it now dominates fields like computing, finance, and biotechnology. The growth of specialized disciplines has led to what sociologists term the "fragmentation of expertise," where mastery is achieved in increasingly narrow sub-domains. The historical evolution culminated in a definition where technical skills are intrinsically linked to the ability to manage complexity, whether that complexity resides in physical systems (like a reactor) or abstract systems (like a deep learning algorithm). This modern context emphasizes the cognitive burden of specialization and the continuous demand for updating specialized knowledge in rapidly changing professional environments.

### 3. Key Characteristics of Technical Knowledge

A defining characteristic of technical knowledge is the interplay between **explicit knowledge** and **tacit knowledge**. Explicit technical knowledge is that which can be codified, documented, and transmitted through manuals, blueprints, textbooks, and formal instruction--this includes formulas, procedures, and terminology. Conversely, tacit technical knowledge encompasses the intuitive skills, accumulated experience, and nuanced judgment acquired through years of practice that cannot be easily written down. While the goal of engineering and industrial processes is often to maximize the explicit (to ensure scalability and consistency), true technical mastery requires a robust integration of both. A skilled technician not only knows the steps (explicit) but also possesses the instinctual ability to diagnose unique faults or adapt standard procedures to novel situations (tacit), demonstrating the holistic nature of high-level technical proficiency.

Technical domains are characterized by their stringent requirement for precision, methodological rigor, and reproducibility. Every action within a technical process, whether calibrating scientific equipment or writing lines of code, must adhere to strict, validated standards to ensure reliability. This focus on method requires the use of specialized, often dense, technical language or jargon. This specialized nomenclature serves a crucial function: it allows experts to communicate complex ideas and precise states efficiently without ambiguity. While jargon can be exclusionary to laypersons, within the technical community, it acts as a necessary tool for maintaining high fidelity in communication and execution. Errors in technical fields often carry significant consequences, reinforcing the necessity for this systematic, detail-oriented approach.

Furthermore, technical knowledge is inherently practical and problem-solving oriented, distinguishing it from purely theoretical science. Whereas theoretical science might ask "why," the technical expert asks "how" and "how effectively." This applied orientation means that technical skills are geared toward intervention, construction, optimization, and maintenance--the core activities of applied disciplines. The evaluation of technical success is typically based on the functionality of the outcome: does the bridge stand? Does the circuit work? Is the software bug-free? This pragmatic feedback loop continually refines technical methods, driving innovation not through abstract speculation, but through iterative design and practical testing in real-world

environments.

#### 4. Technical Competence and Cognitive Psychology

From a cognitive psychology perspective, **technical competence** involves a distinct set of cognitive skills related to spatial reasoning, sequential processing, and domain-specific memory structures. Technical experts often possess highly organized schemata that allow them to rapidly categorize problems, retrieve relevant procedures, and execute multi-step processes efficiently. This competence aligns closely with concepts like practical intelligence, as defined by researchers such as Robert Sternberg, which emphasizes the ability to solve real-world problems through specific, learned skills rather than relying solely on abstract academic knowledge. The development of technical skill requires dedicated practice (often modeled by the concept of 10,000 hours of deliberate practice) to automate complex sequences, freeing up cognitive resources for higher-level diagnosis and creative problem-solving.

The concept of the "scientific specialization or personality" mentioned in the source material highlights the psychological traits frequently associated with technical professionals. This profile often includes a strong preference for data over intuition, a high degree of conscientiousness, and an intense focus on detail. Individuals thriving in technical roles often exhibit enhanced analytical thinking skills, characterized by the ability to break down vast, complex systems into manageable sub-components for diagnosis and repair. This systemic approach is crucial for mastering fields ranging from complex industrial maintenance to network architecture. Furthermore, the technical personality often displays a low tolerance for ambiguity, preferring measurable results and verifiable facts, which drives the rigorous demand for precision inherent in technical work.

Vocational psychology examines how individuals develop a technical identity and how educational systems foster technical aptitudes. Effective technical education transcends simple rote memorization, focusing instead on developing deep conceptual understanding alongside practical application--the "hands-on" component. The process of acquiring technical skill often involves mastery hierarchies, where learners progress from novice status (following explicit rules) to expert status (developing intuitive, adaptive judgment). This trajectory not only builds technical knowledge but also instills professional ethics regarding safety, quality control, and responsibility, linking the technical skill set directly to professional accountability within industrial and scientific settings.

#### 5. The Spectrum of Technical Fields

Technical fields can broadly be categorized into several major spectra, dictated by the nature of the application. The most commonly recognized category involves **hard technical skills**, which deal directly with physical or structured computational systems. This includes traditional engineering disciplines (civil, electrical, mechanical), specialized trades (plumbing, welding,

machining), and core information technology roles (network administration, software development). These skills are often codified by specific certifications and standards (e.g., ISO specifications, professional engineering licenses) and require continuous professional development due to the rapid advancement of tools and methodologies. Success in these domains is typically objectively measured by the performance and reliability of the constructed or maintained system.

A second, increasingly vital spectrum involves domains that apply rigorous, specialized methodology to abstract data or processes, sometimes termed analytical or managerial technical skills. This includes advanced statistical modeling, data science, financial engineering, and specialized project management frameworks (like Agile or Six Sigma). While these skills may not involve physical machinery, they rely heavily on structured algorithms, formal procedures, and highly specialized software tools. Mastering these areas requires an understanding of the underlying mathematical or logical framework, translating complex data into actionable insights, and developing specialized communication techniques necessary to convey highly specific findings to stakeholders.

A crucial distinction often arises in professional development between technical mastery and managerial leadership. Many professionals begin their careers leveraging deep technical expertise but eventually transition into roles requiring broader strategic oversight, personnel management, and financial planning. This transition often proves challenging because the skills that guarantee technical success (detail orientation, focus on system mechanics, specialization) may clash with the requirements of leadership (generalization, communication fluidity, motivational psychology). Effective organizational structure relies on both highly specialized technical experts who maintain operational integrity and managerial staff who understand how to integrate these technical capabilities into broader organizational objectives.

## 6. Technical Documentation and Standardization

The output and maintenance of technical expertise are inextricably linked to the creation of rigorous and precise documentation. **Technical documentation** serves multiple critical functions: it acts as a permanent record of design decisions, provides instructional material for training new personnel, ensures compliance with legal and safety regulations, and facilitates knowledge transfer across geographically dispersed teams. Whether in the form of specifications, user manuals, white papers, or blueprints, this documentation must be unambiguous, complete, and accurate, reflecting the methodological exactitude inherent in the underlying technical discipline. The quality of documentation is often a direct measure of the maturity and professionalism within a technical field.

Standardization is the framework that allows technical knowledge to be globally applicable and reproducible. Organizations like the [International Organization for Standardization \(ISO\)](#) and

national bodies such as the American National Standards Institute (ANSI) develop and maintain protocols that dictate everything from material composition and process control to quality management systems. Adherence to these technical standards is vital, particularly in critical infrastructure, aerospace, and medical device manufacturing, where deviations can result in catastrophic failure. Standardization ensures that specialized technical skills, regardless of where they are practiced, result in products and services that meet predefined criteria of reliability and performance.

The discipline of **technical writing** is itself a specialized technical skill, focusing on translating complex, domain-specific information into formats appropriate for various technical and non-technical audiences. This process requires not only mastery of the subject matter but also a deep understanding of instructional design and cognitive load principles. Technical writers must bridge the gap between the expert who possesses the tacit knowledge and the user who needs the explicit steps. The demand for clarity and conciseness--exemplified by the requirement for a concise "four-page" manual--underscores the need for effective technical communication to be efficient, actionable, and devoid of unnecessary ambiguity or superfluous detail.

## 7. Further Reading

[Techn? \(Greek Philosophy\)](#)

[Technical skill](#)

[Engineering](#)

[Vocational Education](#)