



Emerging Technology Literacy: Collaboration, Access, Impact, Resilience, Security (CAIRS) Framework for Equity

Emerging Technology Community of Interest (COI)

Emerging Technology Accelerator (Accelerator)

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Synopsis

To ensure the effective, ethical, and responsible use of emerging technologies across the Federal government, their integration requires a focus on Emerging Technology Literacy (ETL) approaches that incorporate equity considerations. This paper introduces the Collaboration, Access, Impact, Resilience, Security (CAIRS) framework as a tool to assess whether equity and open innovation considerations are incorporated in ETL approaches. By prioritizing increased access and flexible utilization by public servants, Federal agencies can accelerate the achievement of the U.S. government's most critical objectives.

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The ACT-IAC Emerging Technology Community of Interest mission is to provide an energetic, collaborative consortium comprised of leading practitioners in data science, technology, and research, engaged with industry, academia, and public officials and executives focused on emerging and leading technologies which transform public sector capabilities. The Accelerator provides a collaborative forum where business representatives, technologists, and researchers who work in public sector technology can focus on emerging technologies which address the incorporation of equity across emerging technology design and development.

Disclaimer

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Introduction and Executive Summary

To ensure the consistent integration of emerging technologies across the Federal government, Emerging Technology Literacy (ETL)—the ability to use any emerging technology effectively, ethically, and responsibly—is required. Organizational resiliency with the advent of emerging technologies requires a foundational understanding of these equity¹ considerations. The consequences of not integrating equity across ETL approaches will result in faulty technologies and implementations whose subpar capabilities can significantly erode the Federal government’s capacity to fulfill its mission objectives. Greater ETL will:

1. Integrate emerging technologies into workforce development and training initiatives across organizations, regardless of the end user’s technical background or ability.
2. Support teaming efforts across diverse sectors and organizations to inform the development of cross-functional teams and drive co-creation.
3. Increase accessibility and establish a baseline understanding to encourage deliberation and support educational approaches, as well as self-learning, thus ensuring the disabled are not further isolated.
4. Promote transparency around how technologies are developed and used.

A basic understanding of various emerging technologies supports increased technological advancement, addresses inequities across the technology sector, and supports an informed U.S. government that can adapt and remain resilient during times of rapid innovation — domestically and internationally.

Background

Technology-focused literacy initiatives increase the accessibility and availability of technologies to diverse audiences. With many emerging technologies, there is often a lack of understanding on the most equitable, efficient, and sustainable approaches to designing and developing these technologies. This lack of an integrated approach requires greater understanding of equity considerations to foster adoption and understanding. The purpose of an ETL approach is not to ensure every entity understands the minutiae of the latest discovery, but rather to equip organizations with tools to ask the right questions and learn more.

Integrating Equity Throughout ETL Approaches

Workforce

Diversity

¹ The term “equity” means the consistent and systematic fair, just, and impartial treatment of all individuals, including individuals who belong to underserved communities that have been denied such treatment, such as Black, Latino, and Indigenous and Native American persons, Asian Americans and Pacific Islanders and other persons of color; members of religious minorities; lesbian, gay, bisexual, transgender, and queer (LGBTQ+) persons; persons with disabilities; persons who live in rural areas; and persons otherwise adversely affected by persistent poverty or inequality.

The creation of inclusive ETL approaches is critical for ensuring people of diverse backgrounds across all sectors have a basic understanding of emerging technologies. ETL approaches should incorporate the diversity, equity, inclusion, and accessibility (DEIA) criteria outlined in Executive Orders (EO) [13895](#) and [14035](#) which establish guidance for Federal agencies to promote equity and address disparities. In conjunction with these EOs, the [Infrastructure Investment and Jobs Act](#) provides guidance for promoting equitable access to address inequities related to emerging technologies. It cites the clear need to foster collaboration between government, academia, and industry to promote research and innovation in the emerging technology sector. In alignment with this guidance, ETL approaches should identify areas for collaboration to consolidate resources and support co-creation to reduce redundancy.

Regulation

Privacy

ETLs must strike a balance between establishing foundational knowledge on emerging technologies while also increasing awareness around security and privacy considerations as technologies evolve. When it comes to equity, underrepresented communities are oftentimes not included in the design and development of technologies and too often are denied access to use of the technologies as well. EO [14028](#) and the recent EO on the “Prohibition on Use by the United States Government of Commercial Spyware that Poses Risks to National Security” signal to public and private organizations that privacy serves as a cornerstone for how emerging technologies should be designed and used. However, at this time only a single use case provided by the Cybersecurity and Infrastructure Security Agency (CISA) of all the artificial intelligence use cases published by Federal agencies in alignment with EO [13960](#) focuses on privacy. Effective regulation across the emerging technology sector will foster trust in emerging technologies and ETL approaches should integrate this understanding as well.

Along with this, the ACT-IAC Accelerator’s [April 2023 speaker session](#) addressed how the lack of privacy considerations and regulation across the emerging technology sector negatively impacts underrepresented communities through targeted misinformation and disinformation, lack of data transparency, and lack of cross-sector coordination. Transparency around the data collected on people and organizations can provide individuals with agency over how they prefer to use different technologies. Transparency should be included across new iterations of different technologies and shouldn’t stop at initial launch. Along with this, ETL approaches should consider building communities and coalitions around sharing this information to help address the problem.

Ethics

Establishing an ETL approach with equity considerations necessitates careful consideration of ethical dimensions. Key considerations include privacy, data security, algorithmic fairness, and the potential social impact of emerging technologies. Striking a balance between promoting digital literacy and protecting individual rights is vital for enabling informed decision-making, responsible adoption of

technology, and mitigation of unintended consequences. Additionally, inclusive ETL efforts should address the digital divide and promote equitable access for marginalized communities.

Open Innovation

Open innovation serves as a helpful lever for ensuring public and private organizations collaborate early and often when it comes to equitable ETL approaches. ACT-IAC's [Emerging Technology Challenge](#) serves as one example for how to incorporate open innovation through public and private collaboration to drive co-creation. ETL approaches that incorporate open innovation principles foster inclusive participation, increase access to diverse resources, enable co-creation and co-design, and uncover systemic inequities which can lead to creative solutions that account for underrepresented communities. Incorporation of open innovation in ETL approaches also supports the democratization of innovation by providing opportunities for individuals and organizations outside of traditional hubs to contribute. Thus, ensuring that innovation is not confined to a select few experts or entities.

Recommendations

The ACT-IAC Accelerator’s ETL project cross compared 15 digital literacy frameworks and mapped the core components of these frameworks to the key metrics for progress listed in 18 Federal agency Equity Action Plans developed in adherence with EO [13895](#). This analysis informed the development of a framework Federal agencies can use for assessing ETL approaches to ensure equity considerations are appropriately incorporated. We recommend the following framework for assessing an ETL approach to ensure it incorporates equity considerations. The CAIRS (Collaboration, Access, Impact, Resilience, Security) framework identifies five dimensions that support organizations in analyzing potential internal and external factors that impact ETL approaches which incorporate equity.

C	Collaboration	The Collaboration dimension focuses on existing literacy resources which can inform the development of an ETL approach and opportunities for partnering, co-creation, and open innovation. It includes factors such as existing data, existing literacy frameworks, Federal-wide literacy resources, congressionally mandated resources, and existing public sector focused coalitions or councils. <i>Organizations assess how these factors can inform and support an ETL approach.</i>
A	Access	The Access dimension assesses potential barriers to access depending on the characteristics of the demographic(s) an ETL approach is focused on. It includes factors such as lack of data, lack of funding or grants, lack of time, competing demands, lack of career pathways, lack of mentoring or coaching opportunities, lack of community, lack of diversity, lack of educational resources, and lack of clear metrics for job readiness and learning curve advancement. <i>Understanding the potential barriers to access can help organizations address potential delays in knowledge attainment and development.</i>
I	Impact	The Impact dimension explores how technological changes may change an organization’s inclusiveness and engagement of people of diverse backgrounds. It includes strategic planning, engagement with subject matter experts and practitioners, DEIA considerations, social values, demographics, health impacts, social inequities, algorithmic biases, and quality of life considerations. <i>Organizations explore how these factors influence the learning and development of ETL participants to inform the most flexible, simple approaches for developing literacy tools and resources.</i>
R	Resilience	The Resilience dimension examines the organizational and cultural factors that sustain an ETL through economic, social, and political changes. It includes factors such as technological advancements, economic stability, social responsibility, and political stability.

		<i>Organizations assess the impacts of these factors to address organizational and cultural efficiencies, inefficiencies, risks, and issues.</i>
S	Security	The Security dimension examines evolving technological risks and geopolitical influences on these risks. It includes factors such as data privacy, secure data sharing, secure infrastructure, secure development, secure communications, cybersecurity and compliance, and regulatory considerations. <i>Organizations examine how to integrate these factors into the full lifecycle of an ETL approach.</i>

By using the CAIRS framework to inform ETL approaches, Federal agencies can better understand potential internal and external factors impacting the development and sustainment of equitable ETL approaches. This framework also helps Federal agencies in aligning an ETL with mission objectives allowing for flexibility and adaptability regardless of potential impacts from the outlined factors.

Call to Action

As Federal agencies develop ETL approaches, increased access and ease of use by public servants must remain top of mind. In alignment with Federal agency Equity Action Plans, ETL approaches should incorporate equity considerations as a fundamental commitment to reduce and ultimately eliminate inequities regarding emerging technology access and understanding. Over the past year, ACT-IAC’s Accelerator has focused on integrating equity across emerging technology design and development and over 120+ ACT-IAC volunteers have participated in Accelerator activities. ACT-IAC volunteers should harness this greater awareness of equity developed with the Accelerator to integrate the CAIRS framework across ACT-IAC working groups, projects, pilots, and initiatives to continue to develop and refine the framework and greater ETL approaches.

Public servants require clear cut approaches for harnessing the power of emerging technology in their day-to-day jobs. Technology focused literacy approaches of the past which lack equity considerations and require an exorbitant of training time and formal requirements will only delay government understanding of emerging technologies that support mission objectives. This paper serves as a call to action for development of ETL approaches that incorporate equity and open innovation considerations.

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Appendix — Equity Action Plan Matrix

The matrix below outlines key metrics identified by the Urban Institute in Federal agency Equity Action Plans for measuring progress on equity. The gray cells in the matrix indicate that no metrics were identified for the applicable CAIRS framework dimension. For descriptions on each of the framework dimensions, please reference the “[Recommendations](#)” section of this paper.

No.	Agency	Collaboration	Access	Impact	Resilience	Security
1	Consumer Financial Protection Bureau		<ul style="list-style-type: none"> - Number of fair lending actions and amount of relief offered (p. 7) - Number of Special Purpose Credit Programs offered (p. 7) 	<ul style="list-style-type: none"> - Completion of DEIA strategic plan goals (p. 5) - Incorporation of racial and economic equity principles in future strategic planning (p. 5) - Percentage of financial institutions that have implemented practices to prevent algorithmic bias in lending (p. 9) 	<ul style="list-style-type: none"> - Completion of Section 1033 rulemaking (p. 9) 	

No.	Agency	Collaboration	Access	Impact	Resilience	Security
2	Department of Agriculture		<ul style="list-style-type: none"> - Increase annual average monthly participation in the Special Supplemental Nutrition Program for Women, Infants, and Children by more than 350,000 over the strategic plan’s time frame (pp. 11–13) - Delivering 40 percent of “investment benefits from certain federal programs to disadvantaged communities” (p. 15) - Move goal from 16 percent to 21.5 percent allocation of contracting dollars going to small disadvantaged businesses (p. 17) - Expand tribal pilot participation by 30 percent with increased outreach and funding (p. 20) 			

No.	Agency	Collaboration	Access	Impact	Resilience	Security
3	Department of Commerce	<ul style="list-style-type: none"> - Number of organizations that agree to collaborate with engagement efforts, level of event participation (p. 15) - Number of new partnerships as part of Joint Venture Partnership Program that help drive participation among underserved communities (p. 19) 	<ul style="list-style-type: none"> - Number of homes or locations passed by broadband, number of households receiving subsidized or free broadband services, number of training hours provided (p. 8) - Dollars awarded related to capital and contracts, firms reporting an increase in profit and number of jobs created and retained (p. 12) - Number of preloaded laptops distributed (p. 16) - Number of educational programs initiated across historically underserved communities and increases in number of attendees (p. 16) - Number of export control inquiries received after production of bilingual supporting documents (p. 19) 	<ul style="list-style-type: none"> - Number of small businesses in underserved communities assisted (p. 3) - Number of firms served and number of firms successfully applying for State Small Business Credit Initiative program (p. 12) - Number of students from historically underserved communities who express newfound interest in pursuing careers in intellectual property or becoming inventors (p. 15) - Number of patent applicants who represent themselves and complete application process (p. 15) - Increases in practitioner participation (p. 16) - Percentage of participants from historically underserved communities with the citizen science program, number of Weather Ready National Ambassadors focused on service equity, number of injuries and/or fatalities in historically underserved and socially vulnerable communities after hazardous weather events (p. 18) 		
4	Department of Education	<ul style="list-style-type: none"> - Building peer reviewer tracking system (with cross-agency insight) (p. 18) 	<ul style="list-style-type: none"> - Free Application for Federal Student Aid filing rates, disaggregated by demographics (p. 8) 	<ul style="list-style-type: none"> - Key performance indicators to track the equitable impact of American Rescue Plan 	<ul style="list-style-type: none"> - Building equity dashboard for grantmaking processes (p. 19) 	

No.	Agency	Collaboration	Access	Impact	Resilience	Security
				funding for K-12 Students (p. 11)		
5	Department of Health and Human Services		- Number of unsuccessful grant applications (p. 11)	- Development and use of a Minority Health Social Vulnerability Index (p. 4) - Efforts to reduce maternal-mortality measured through postpartum coverage expansion in Medicaid / Children’s Health Insurance Program and broader health care coverage (p. 15) - Further metrics within the Centers for Medicare and Medicaid Services’ Health Equity plan		
6	Department of Housing and Urban Development		- Number of organizations funded by the Fair Housing Initiative Program and Fair Housing Assistance Program working at the state and local levels (p. 10) - Number of cases referred by Fair Housing Initiative Program organizations (p. 10) - Number of Fair Housing Initiative Program / Fair Housing Assistance Program practitioners attending National Fair Housing Training Academy trainings (p. 10) - Increased availability and utilization of small-dollar mortgage loans (p. 13) - Exits from homelessness (p.16)	- Department of Housing and Urban Development’s capacity to address housing discrimination (p. 10) - Homeownership rates by race (p. 14)	- Number of Fair Housing Act complaints received, processed, and closed (p. 10) - Number of cases processed by Fair Housing Assistance Program organizations (p. 10)	

No.	Agency	Collaboration	Access	Impact	Resilience	Security
7	Department of Interior	<ul style="list-style-type: none"> - Outcomes with tribal universities (p. 17) 	<ul style="list-style-type: none"> - Catalogue and track identified equity barriers (p. 9) - Buy Indian contracting performance and workforce awareness (p. 13) - Use of Indian-owned businesses as subcontractors (p. 14) - New tracking of unmet needs of tribes applying for discretionary grants alongside number and amounts of tribal grants awarded (p. 17) - Land and Water Conservation Fund grant awards to underserved communities; number of partnerships with outfitters, concessions, and commercial services; number of partnerships with nonprofits to provide free or low-expense and disability-inclusive facilitated-experience programs (p. 20) 	<ul style="list-style-type: none"> - Office of Small and Disadvantaged Business Utilization's small-business website traffic, use of small business counseling and education toolkit (p. 13) 	<ul style="list-style-type: none"> - Further evaluation of opportunities to enhance grants program systems and structural design (p. 16) 	

No.	Agency	Collaboration	Access	Impact	Resilience	Security
8	Department of Justice	<ul style="list-style-type: none"> - Number of relevant stakeholder engagement events and alliances (p. 12) 	<ul style="list-style-type: none"> - Number of programs in equity-focused data-collection pilot (p. 6) - Number of programs that add Title VI and other civil rights data-collection requirements or equity performance measures (p. 6) - Number of calls offering limited-English-proficiency support services (p. 9) - Percentage of DOJ contracting dollars awarded to HUBZone firms with the goal of at least 3 percent (p. 12) - Each of DOJ’s major procuring bureaus will “identify at least two contracting opportunities for HUBZone small business each fiscal year for 4 years” (p. 13) 	<ul style="list-style-type: none"> - Percentage of applications from, and the percentage of grants awarded to, culturally specific, community-based organizations (p. 7) - Web views of public-facing content in different languages (p. 9) 		
9	Department of Labor		<ul style="list-style-type: none"> - New indicators of access and barriers to unemployment insurance (p. 10) - Tracking and analyzing unemployment insurance claimant feedback (p. 11) - Employment and Training Administration program participant outcomes (p. 16) 	<ul style="list-style-type: none"> - Equity grantee performance tracked as part of the strategic plan (p. 10) - Mine Safety and Health Administration sign translation (p. 14) 		

No.	Agency	Collaboration	Access	Impact	Resilience	Security
10	Department of Transportation		<ul style="list-style-type: none"> - Department contracting dollars awarded to small, disadvantaged businesses (p. 7) - Number of grant applicants from disadvantaged communities (p. 9) - Number of new projects in disadvantaged communities (p. 9) - Discretionary grant project reporting (p. 9) - Data on demographic groups' service access and usage (p. 10) 	<ul style="list-style-type: none"> - Assessment of metropolitan planning organizations and state departments of transportation inclusion of quantitative equity screenings and representative public participation (p. 8) 	<ul style="list-style-type: none"> - Monitoring of department funding recipients' compliance with "their meaningful public participation obligations" (p. 8) - Measuring benefit of discretionary grant projects to disadvantaged communities (p. 10) 	
11	Department of Treasury		<ul style="list-style-type: none"> - New procurement entrants (p. 10) - Small disadvantaged business achievement (p. 11) 	<ul style="list-style-type: none"> - Taxation equity analyses using new imputation methods (p. 5) 		
12	Environmental Protection Agency	<ul style="list-style-type: none"> - Percentage of EPA programs working in and with communities with environmental justice concerns (p. 10) 	<ul style="list-style-type: none"> - Percentage/number of community grant funds that support science to address environmental justice and equity concerns (p. 18) 	<ul style="list-style-type: none"> - Percentage of significant EPA actions that demonstrate response to environmental justice concerns and address disproportionate impacts (p. 12) 	<ul style="list-style-type: none"> - Output-focused goal monitoring for civil rights compliance (p. 15) - Increased vendor diversification and new entrants tracked in procurement equity dashboard (p. 20) 	
13	Federal Communications Commission		<ul style="list-style-type: none"> - Number of Affordable Connectivity Program enrollments and claims (p. 6) - Number of Emergency Connectivity Fund applications and claims (p. 8) - Quality and availability of broadband services (p. 9) 		<ul style="list-style-type: none"> - Adopting final rules to facilitate equal access to broadband no later than November 15, 2023 (p. 5) 	

No.	Agency	Collaboration	Access	Impact	Resilience	Security
14	Federal Emergency Management Agency		<ul style="list-style-type: none"> - Additional applicants and amount of financial assistance provided for clean-and-sanitize assistance (p. 10) - Additional applicants and amount of financial assistance provided for mold remediation assistance (p. 10) - Percentage of ownership verification done via in-person inspector visits (p. 10) - Decrease in flood insurance gap (p. 17) 		<ul style="list-style-type: none"> - Percentage of occupancy verification done through new documentation process (p. 10) 	
15	Federal Trade Commission		<ul style="list-style-type: none"> - Collection and analysis of procurement and contracting data (p. 1) 		<ul style="list-style-type: none"> - Use of toolkit is embedded in staff's work (p. 5) - Trainings for internal staff (p. 10) 	<ul style="list-style-type: none"> - Creation of new policies/initiatives, community outreach, and law enforcement actions that address relative harms to different market participants (p. 5)
16	National Science Foundation	<ul style="list-style-type: none"> - Number of community engagement activities completed by NSF (p. 11) 	<ul style="list-style-type: none"> - Progress toward achieving high response rates in demographic data collections (p. 7) - Increase in the number of small and disadvantaged entities receiving prime and subcontract awards (p. 9) - Percentage of small, disadvantaged businesses among total annual contract obligations (p. 9) 	<ul style="list-style-type: none"> - Progress toward adhering with agency antiharassment policies across grantees overall and by different types of institutions (p. 6) 	<ul style="list-style-type: none"> - Progress toward receiving useful responses from respondents to NSF data (p. 7) 	

No.	Agency	Collaboration	Access	Impact	Resilience	Security
17	Small Business Administration	<ul style="list-style-type: none"> - Increase in the number of organizations partnering with the Small Business Administration (p. 14) 	<ul style="list-style-type: none"> - Increase in dollars spent on small disadvantaged businesses by Federal agencies (p. 9) - Increase in the number of Federal procurement and contracting opportunities available for small businesses (p. 9) - Increase in the number of small disadvantaged businesses participating in Federal procurement and contracting (p. 9) - Increase in the number of underserved disaster survivors utilizing Small Business Association-referred financial counseling (p. 12) - Increase in the number of underserved disaster survivors utilizing Small Business Association products and services (p. 12) - Increase in the number of organizations partnering with the Small Business Association to assist underserved disaster survivors (p. 12) - Increase in the number of underserved entrepreneurs utilizing Small Business Association resources (p. 14) 		<ul style="list-style-type: none"> - Increase in the two-year survival rate for new businesses of underserved entrepreneurs (p. 14) 	

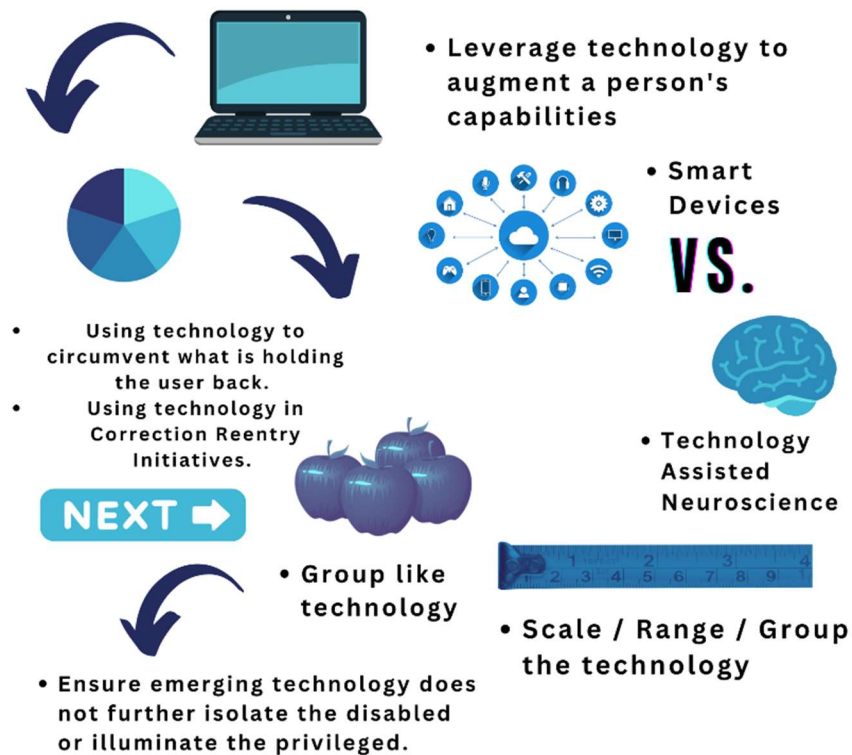
No.	Agency	Collaboration	Access	Impact	Resilience	Security
18	Social Security Administration		<ul style="list-style-type: none"> - Increase in participant information gathered, such as race and ethnicity for Social Security number card applications (p. 10) - Percentage of claimants obtaining representation at all stages of the disability process and their claim outcomes (p. 16) - Percentage of represented claimants at all stages of the disability application process (p. 16) - Percentage of research grants and procurement opportunities awarded to historically Black colleges and universities, minority-serving institutions, and small and disadvantaged businesses (p. 20) 	<ul style="list-style-type: none"> - Earnings, benefit amounts, income, poverty, health, and wealth of each racial/ethnic group (p. 9) 		

Appendix — Pilot Opportunities

Listed below please find a poster presented at ACT-IAC's [Use Case Summit](#) held on September 19, 2022. The poster includes ideas gathered by the ACT-IAC Accelerator's ETL project volunteers for different areas to cover in ETL approaches. These areas could serve as potential follow-on pilot opportunities for integrating the CAIRS framework across ETL approaches.

Technology Literacy

What is Technology Literacy? What would the entry level be for today's knowledge worker? What would be the entry level be for today's patient? How much does someone need to know about technology to operate a car, order at McDonalds, read a book, go to school, read a position paper for Congress? Is there one answer for any of these questions? No, of course not. Nor should there be. Every person is different. However, when looking at a food label various scales or counts are seen. There is also a Health Literacy scale that was not there a few decades ago. Technology will continue to increase, and society must ensure it is understandable as are technology scales.



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