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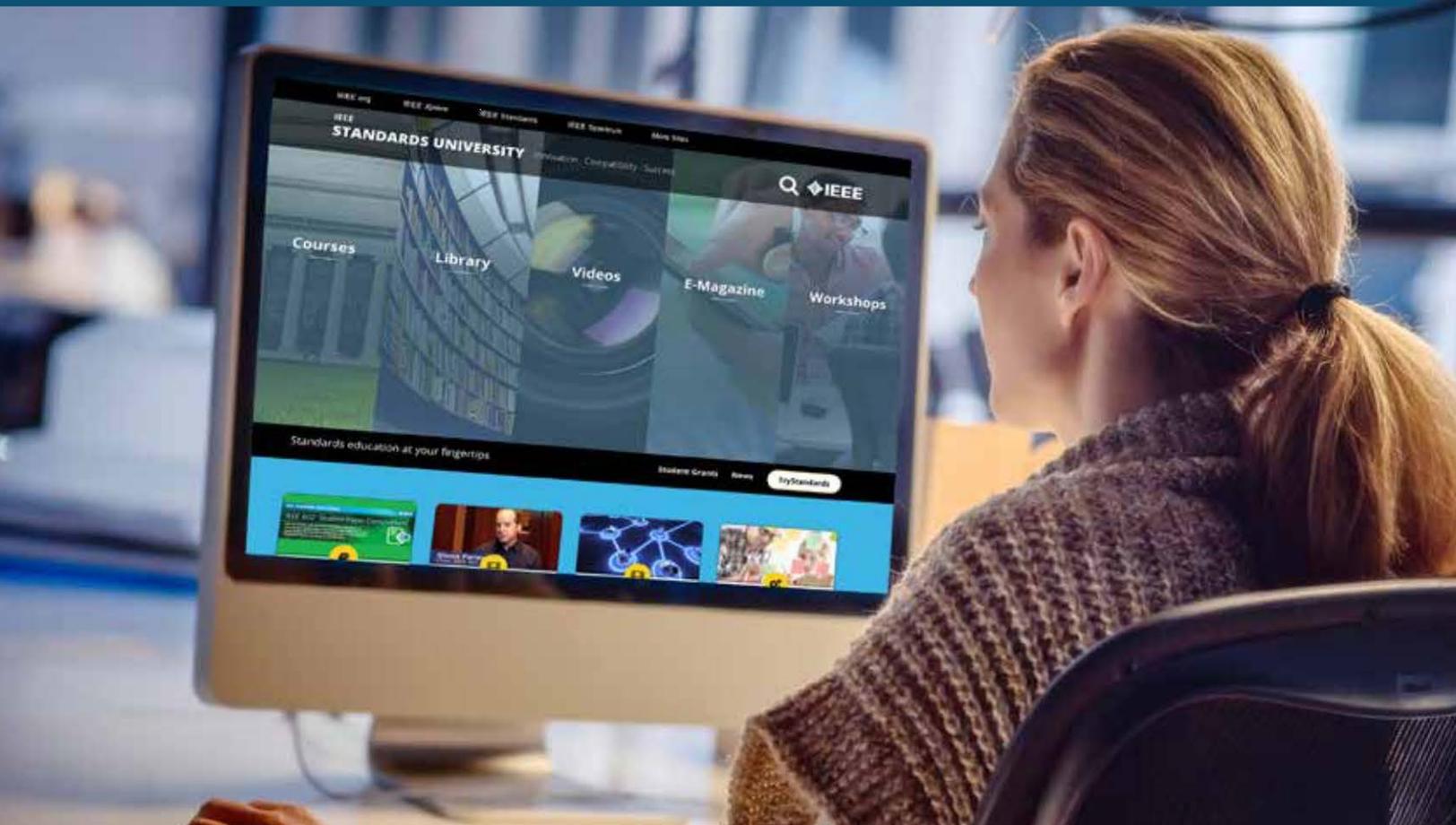
IEEE Standards Education Video Series



Curriculum Packet

VIDEO I

Standards Education: An Introduction



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Video Summary and Topics

This video explores the history and evolution of standards, with a look at their role and benefits, the categories under which they fall, and their place in the global marketplace.

Topic 1: Introduction to standardization (Clip begins at 0:53 and ends at 3:09)

The introduction briefly speaks to the history of standards development, beginning with the story of a devastating fire that could not be extinguished because of faulty hydrants.

Topic 2: Introduction to IEEE (Clip begins at 3:10 and ends at 5:01)

In this segment, IEEE is described and its standards development program is introduced. The scope of IEEE's standards library covering a broad base of technologies is acknowledged. Also discussed is IEEE's Standards Education Committee, which promotes standards' role in addressing technical, economic, environmental, and societal issues.

Topic 3: Introduction to CNIS (Clip begins at 5:02 and ends at 6:12)

Introduced in this section is the China National Institute of Standardization (CNIS), an organization centered on standardization research, theory, strategy, and education, as well as standards development.

Topic 4: Brief history of standardization (Clip begins at 6:13 and ends at 9:18)

In this segment, a brief historical view of standardization unfolds, highlighting standards that originated in ancient civilizations; the dangerous consequences that sometimes resulted when standards were not used during the Industrial Revolution; and the need for standards as technology has emerged and continues to evolve.

Topic 5: Basic concept of standardization (Clip begins at 9:19 and ends at 10:06)

This segment explains what comprises standards, what they are designed to do, and how they influence the global marketplace.

Topic 6: What is a standard? (Clip begins at 10:07 and ends at 11:10)

Discussed in this segment is the role of standards in areas such as product development, consumer safety, interoperability, and international trade.

Topic 7: Types of standards (Clip begins at 11:11 and ends at 14:00)

This section outlines the basic types of standards: product, process, service, de jure, de facto, and voluntary.

Topic 8: Benefits of standards (Clip begins at 14:01 and ends at 15:16)

Described in this segment are the myriad benefits that standards provide, from expediting product development to ensuring safety and reliability.

Pre-viewing Discussion Questions

It is recommended that students' responses to the pre-viewing questions also be revisited after watching the video so students can either affirm or rethink their initial contributions.

- 1. Think about an item you use every day. How do the different components contained within the item work together? What ensures their interoperability, safety, and functionality?**

Possible responses:

Answers will vary but should take into account that interoperability, safety, and functionality requirements must be considered at the product design stage and before products are manufactured. The guidelines for these requirements are often outlined in technical standards. Consumers trust that these requirements are met, and often look for proof of this via conformity assessment logos and symbols.

- 2. What procedures, processes, rules, etc., do you think are in place to guide the development of products that engineers create?**

Possible responses:

Students might suggest development guidelines, federal and state laws, standards, prototypes and testing, certifications, consumer reviews, and related practices.

- 3. What would happen if there were no guidelines or frameworks for product development?**

Possible responses:

Devices could malfunction, operate inefficiently, cause harm, only work in certain markets and not others, etc. Such issues would affect business, product safety, manufacturing, and the like.

Post-viewing Discussion Questions

1. What does history tell us about the beginning of standardization?

Responses/discussion points:

The Baltimore fire pointed to a serious flaw in the structure of fire hydrants, which prevented firefighters from using water from the hydrants. The result was a highly destructive fire, a disaster that underscored the need for national standards to ensure the appropriate design, development, and function of hydrants in the future. Standardization traces back to the ancient civilizations of Babylon, Egypt, and China, identified through archaeological relics as well as written documents pointing to standards for weights and measures; and products and services in agriculture, ships, buildings, weapons, and currency. During early nineteenth century industrialization, standards were sometimes sidelined, resulting in inefficiencies and the endangerment of public safety. These situations led the call for standards to guide the efficient and safe operation of emerging technology. The beginnings of standardization led the way for continued and enhanced standards development.

2. Explain why standards are important in the world of technical development and innovation.

Responses/discussion points:

History points to the dangers of technologies that are poorly developed. Nowadays, technological innovation is extensive, thus requiring standards to support interoperability in order to avoid flaws, minimize risks, and enable different products from different vendors to work together. Standards can help reduce the risk that designers, developers, and manufacturers might take that affect product safety, efficiency, durability, etc.

Standards address issues ranging from product compatibility to consumer safety and health concerns. They simplify product development and reduce non-value-added costs, thereby increasing users' ability to compare competing products. Standards are fundamental building blocks for international trade and enable the rapid implementation of technology. Standardization is essential in the competitive global marketplace. Many companies have integrated standardization into the technical and commercial elements of their business planning.

3. What are the benefits of standards?

Responses/discussion points:

Standards:

- Can define a common language for stakeholders including the public, manufacturers, consumers, governments, businesses, and educators
- Help lower the costs of production, implementation, training, and manufacturing
- Help ensure product safety, reliability, compliance, and acceptance

- Establish product compatibility and interoperability
- Make it easier to understand and compare competing products
- Encourage innovation
- Speed the time to market for new products
- Help reduce the risk of product liability
- Enable competition
- Help demonstrate social responsibility and reduce the need for regulation
- Facilitate international trade
- Guide global requirements
- Propel investment in technology by lowering risk

4. Can standards change over time? What might drive this change?

Discussion points:

Standards tend to evolve over time, especially in the ever-changing technological realm. Innovation, changing market demands, and improved safety considerations are examples of what can drive the revision of existing and creation of new standards.

Post-viewing Assessment Questions

A distribution-ready assessment is available in the addendum.

1. What does history tell us about standardization? (ANSWER: A)

- A) It is a continually evolving process.
- B) It guarantees the longevity of political leadership.
- C) It is a process linked only to manufacturing.
- D) It is an unflawed process that rarely changes.

2. True or False: (ANSWER: A)

Technology, globalization, innovation, and international trade drive 21st century standardization.

- A) True
- B) False

3. What is the difference between design standards and performance standards? (ANSWER: C)

- A) Design standards describe how a product should look, whereas performance standards describe how well it should function.
- B) Design standards describe how a product should function, whereas performance standards describe how it should be made.
- C) Design standards describe how a product should be made, whereas performance standards describe how it should function.
- D) Design standards describe how stylish a product is, whereas performance standards describe how well it should function.

4. What is the difference between de facto standards and de jure standards? (ANSWER: D)

- A) De facto standards are developed only by consumers, whereas de jure standards are developed by formal organizations using known processes.
- B) De facto standards address defects, whereas de jure standards address jury practices.
- C) De facto standards develop through wide use and market acceptance, whereas de jure standards are developed by start-ups to challenge de facto standards.
- D) De facto standards develop through wide use and market acceptance, whereas de jure standards are developed by formal organizations using known processes.

5. True or False: Standards create competition, increased safety, and improved communication among stakeholders. (ANSWER: A)

- A) True B) False

6. What role does consensus play in the development of standards? (ANSWER: D)

- A) Consensus plays no part in developing standards. Organizations like IEEE have the power and responsibility to create standards, so no consensus is needed.
- B) Consensus plays a limited role in developing standards. IEEE and CNIS each develops standards, thus the two organizations must reach consensus.
- C) Consensus plays only an implicit role in developing standards. The market is the final arbiter for standards, and market approval can be considered a form of consensus.
- D) Consensus plays an integral role in developing standards. Members of recognized professional organizations establish standards through reaching consensus.

7. Which of the following is true of standards? (ANSWER: B)

- A) Standards discourage innovation because they require creators to work within boundaries.
- B) Standards make it easier for consumers to compare products.
- C) Standards impede globalization because they force the developing world to adapt to the developed world.
- D) Standards make it more expensive to implement new products.

8. ISO, IEEE, GB, and ANSI are acronyms for: (ANSWER: C)

- A) Specific types of standards
- B) Technical protocols
- C) Standards development organizations
- D) Standards development procedures

9. True or False: (ANSWER: B)

The development of standards heightens the need for regulation within the context of international trade.

- A) True B) False

10. The absence of standardization can lead to (ANSWER: D)

- A) Reduced innovation
- B) Product liability
- C) Declining consumer safety
- D) All of the above

Learning Activities

1. Explaining Standards

Students can draft a “Standards for Dummies®”-type report that introduces a primary standard connected to a product they are interested in or are studying. In this task, students have to describe the standard in “user-friendly” terms and explain the rationale that led to its creation. Students can view the “report” as a potential tool that benefits future undergraduate students learning about standardization.

2. Standards Development and Change

Students can explore up to three standards associated with a product of interest or an element of a product related to the industry they are studying. For example, they might select a cell phone charger or battery, or a car airbag or engine. Students determine how the selected standards have influenced the product to date, and based on product changes over time, discuss where its related technology might be headed in the future. They consider these questions in their exploration:

- In general, how will standards change as technology continues to rapidly evolve?
- How will product-specific standards change in the future?
- What standards might need to be created to address technological shifts?

3. Connecting Products and Standards

In small groups, students can explore how a family of standards, important to a specific industry they are studying, has had an impact on said industry over time. Groups present their findings to the class in a format they choose. As a class, students informally discuss the role and impact of standards, drawing on what they learned from each other’s research.

Case Studies

Case studies present real-world situations in which standards are applied. Use these for group or independent research tasks that respond to a set of questions relevant to the industry being studied. Alternatively, students can use the case studies to analyze, for example, the impact or benefit of standards, standards development, and related topics. The learning outcomes depend on how a selected case study links to a course syllabus and/or the concepts on which students focus.

IEEE, IEEE Standards Presents: Case Study 515. IEEE Standards University: 2015

<http://www.standardsuniversity.org/video/ieee-standards-presents-case-study-515/>

Concepts:

Standards development process for electrical trace heating, process industry, consensus building, need for new standards

Synopsis:

Rich Hulett, IEEE Life Fellow, discusses the initial challenges and ultimate global success of IEEE Standard 515 and how this consensus standard changed the direction and future of the process industry forever. Represents a great example of how a standard can help create the environment for a market.

ISO, Electrical Devices Joint Stock Company No. 1 (VINAKIP) Vietnam, Economic Benefits of Standards-International Case Studies-Volume 2, pp. 93–113, 2012, Geneva, Switzerland.

www.iso.org/iso/pub100288.pdf

Concepts:

Electrical products, economic benefits and impact of standards, purpose and application of standards, design phase, suppliers and customers, standard information networks, value chain and drivers, company attitude towards standards

Synopsis:

This case study was designed to assess the economic benefits of standardization to the Vietnamese electric device manufacturer VINAKIP. The study examines the company's use of standards across the value chain.

Standards New Zealand, Standards: Key to Winning Lucrative Australian Contracts, Case Studies on the Benefits of Standards, Wellington, NZ. Standards New Zealand, Ministry of Business, Innovation, and Employment.

<https://www.standards.govt.nz/assets/News/Case-studies/CaseStudyJackson.pdf>

Concepts:

Business and economic benefits of standards, electrical products for construction companies, consumer safety

Synopsis:

In this case study, a New Zealand business owner speaks to his success as a result of standards.

Gonzalez, L., The Results of a 1-Year Net-Zero-Energy Home Case Study, Clean Technica, 2014.

<http://cleantechnica.com/2014/07/21/results-1-year-net-zero-energy-home-case-study/>

Concepts:

Product development and testing through the laboratory, exploration of Net-Zero Energy home standards, standards comparison

Synopsis:

This study reports on a trial energy project that looks at energy usage in a Net-Zero Energy home and how its success, within a laboratory test environment, can influence existing home energy and construction standards and regulations.

Readings

The readings expand on a few of the primary themes presented in the video. As with the case studies, articles can further student knowledge about specific concepts or topics, and/or can serve as the basis for independent or group projects.

Potter, B. and Behr, M., Model-based design facilitates compliance to aerospace standards, *Military Aerospace*, vol. 21, no. 3, 2010.

<http://www.militaryaerospace.com/articles/print/volume-21/issue-3/departments/opinion/model-based-design-facilitates-compliance-to-aerospace-standards.html>

Concepts:

Importance of standards compliance, model-based design as a way to facilitate conformance and validate requirements, process of incorporating and verifying certified standards-driven systems

Synopsis:

The article looks at a model-based design practice, which can help to ensure that aerospace vehicles easily and readily address the development and verification of certified systems. This approach helps engineers find design errors earlier in the development process before significant rework and redocumentation become necessary.

Blind, K., Jungmittag, A., and Mangelsdorf, A., The Economic Benefits of Standardization. DIN German Institute for Standardization: 2011.

<http://www.din.de/blob/89552/68849fab0eeeaafb56c5a3ffee9959c5/economic-benefits-of-standardization-en-data.pdf>

Report summary: <http://www.astm.org/BusLink/BusLinkA01/DIN.html>

Concepts:

Value of standards to corporations and a nation's economy, competition, cost reduction, impact on supplier/client partnership, cooperation among businesses

Synopsis:

This study emerges from a survey of companies in Germany, Austria, and Switzerland representing ten different industries. The report highlights the impact standards have on the overall cost of doing business and the economic benefits standards can render.

Resources

Articles

Bartleson, Karen. (2014, Dec) **The Road to Intelligent Vehicles is Paved with Standards.** *Electronic Design.*

<http://electronicdesign.com/communications/road-intelligent-vehicles-paved-standards>

Examines the role technical standards have in automobiles' expanding technological advances

(Audience: student)

Cenelec. **What is a European Standard (EN)?**

<http://www.cenelec.eu/standards/DefEN/Pages/default.aspx>

Describes what European Standards are and the organizations that ratify them

(Audience: instructor and student)

Epperson, Beth. (2014, Nov) **Choosing Standards Compliance Over Proprietary Practices.** *MDN.*

https://developer.mozilla.org/en-US/docs/Choosing_Standards_Compliance_Over_Proprietary_Practices

Explores the importance of conforming to open technology standards that are external to the organization

(Audience: instructor)

Marasco, Amy A. **Standards Development: Are You At Risk?** *ANSI News and Publications.*

http://www.ansi.org/news_publications/other_documents/risk.aspx?menuid=7

Explores the legal issues that can arise when rules for participation in the voluntary consensus standards development process are not properly followed

(Audience: instructor)

Masum, H., Lackman, R., and Bartleson, K. (2013, Oct) **Developing Global Health Technology Standards: What Can Other Industries Teach Us?** *Globalization and Health*, vol. 49, no. 9.

<http://globalizationandhealth.biomedcentral.com/articles/10.1186/1744-8603-9-49>

Discusses how to better develop standards for global health technologies

(Audience: student)

Books

Busch, L. (2011) *Standards: Recipes for Reality*. Cambridge, MA: The MIT Press.

<https://mitpress.mit.edu/books/standards>

Investigates standards as tools that shape not only the physical world around us, but also our social lives and even ourselves

(Audience: instructor)

Standards Information

Engineering Student Resources

<https://www.asme.org/about-asme/standards/engineering-student-resources>

Provides varied introductory materials addressing the basics of standardization

(Audience: student)

IEEE: Publications and Standards

http://www.ieee.org/publications_standards/index.html

Offers access to a range of IEEE resources that make the exchange of technical knowledge and information possible among technology professionals

(Audience: instructor and student)

Information Technology Standards

<http://its.sis.pitt.edu/NIST/>

Provides an introduction to information technology standards

(Audience: instructor and student)

National Resource for Global Standards: Search Engine for Standards

<http://www.nssn.org/>

Tool that facilitates the searching for standards across industries

(Audience: instructor and student)

NIST Global Standards Information

<http://gsi.nist.gov/global/index.cfm/L1-5>

A virtual standards primer

(Audience: student)

Standards Learn

<http://www.standardslearn.org/>

An expansive collection of standards-focused resources

(Audience: student)

Videos

Berners, Tim and Bartleson, Karen. **Tim Berners-Lee and Karen Bartleson on Open Standards: SXSW Forbes Exclusive.** Forbes. *YouTube*. 11 March 2013.

<https://youtu.be/puUkyldFZik>

Discussion of the importance of open standards and the future of the Internet

(Audience: student)

World Without Standards—Lights Out. IEEE Standards Association. *IEEE Standards University*. *YouTube*. 9 June 2015.

<https://www.youtube.com/watch?v=H-sO4OpA9SM>

Demonstrates how IEEE 1264-2015, IEEE Guide for Animal Deterrents for Electric Power Supply Substations, keeps lights on

(Audience: student)

Glossary

de facto standards: Standards that have come into use by general acceptance, custom, or convention but have no formal recognition.

de jure standards (formal standards): Standards that are developed by formal standards organizations, using well-established procedures based on openness, transparency, balance, due process, and the right of appeal.

design standards: Standards that specify the design or technical characteristics of a product in terms of how it is to be constructed, assembled, or manufactured.

interoperability: Ability of a system or a product to work with other systems or products without special effort on the part of the customer. Interoperability is made possible by the implementation of standards.

mandatory standards: Standards incorporated into laws or technical regulations for the protection of public health, safety, and the environment; or when incorporated into contractual agreements between buyers and sellers.

performance standards: Standards specify the level of expected performance for a product, not how it should be designed, and may include test methods that simulate performance under actual conditions.

process standards: Standards that relate a series of actions or operations used in making a product and provide the methodology to perform these processes in a consistent and reproducible way.

product standards: Standards can either define how the product should perform or how it should be designed.

service standards: Standards that establish requirements to be met in order to achieve the designated purpose effectively.

standard: A document that defines the characteristics of a product, process, or service, such as dimensions, safety aspects, and performance requirements.

standardization: The use of common products, processes, procedures, and policies to facilitate attainment of business objectives.

voluntary standards: Distinguishes the standards development process from governmental or regulatory processes. All interested stakeholders participate, including producers; users; consumers; and representatives of government and academia. Voluntary standards can be made mandatory by being incorporated into law by governmental bodies.

For additional terminology and definitions, see the

Standards Glossary

<http://www.standardsuniversity.org/library/standards-glossary/>;

and/or the *Standards Reference Dictionary*

<http://www.standardsuniversity.org/library/ieee-standards-reference-directory/>

Video Transcript:

“Standards Education: An Introduction”

0:51 On Sunday, February 7, 1904, at 11:00 a.m., a fire was reported at a building in Baltimore, Maryland, on the East Coast of the United States not far from Washington, D.C. Firefighters quickly realized the seriousness of the blaze and brought in all of the 24 engines that the city had available, but the fire kept spreading; block after block going up in flames. As early as 1:30 p.m., Baltimore started asking other cities and states for help.

1:24 Washington firefighters and engines arrived first. It was discovered that the couplings of their hoses did not fit the Baltimore hydrants. Firefighters wrapped canvas tightly around the couplings, but the effectiveness of the hydrants was greatly reduced and the fire could not be contained.

1:44 By evening, firefighters from many miles west of Baltimore arrived to help, but the fire grew, aided by the gusting winds and by the firefighters’ inability to use the water from the hydrants.

1:59 The city was saved from complete destruction in a dramatic rescue 30 hours after the fire began, when engines filled from a nearby waterfall created a wall of water at the line of fire to halt it.

2:12 The Great Baltimore Fire caused devastation and suffering. Those who fought it were heroic. But the fire is not remembered for those reasons. It is remembered because, in the immediate aftermath, a cry went up for national standards in the United States—national standards that would ensure compatibility of fire hydrant couplings and so much more. The public understanding of the value of standards had reached a critical point and standards development in many areas began in earnest.

2:49 Standardization is a complex subject. This video is the first in a series designed to teach the basics of standards education. We have chosen to begin with the story of the Baltimore fire to illustrate how important standards are to your life and the lives of everyone you know.

3:14 IEEE is the world's largest technical professional association, with over 400,000 members, dedicated to advancing technology for the benefit of humanity.

3:25 Through its highly regarded and frequently cited publications, conferences, technology standards, and professional and educational activities, IEEE has become the trusted voice on a wide variety of areas ranging from aerospace systems to computers, telecommunications to biomedical engineering and electric power, and consumer electronics.

3:49 As part of its activities, IEEE has an extensive standards development program, with a portfolio of over 900 active standards and more than 500 standards under development. IEEE adheres to the standards development principles of the World Trade Organization, which include openness and transparency. IEEE also supports the principles of Open Stand, the modern paradigm for standards in a global economy, which include cooperation and collective empowerment.

4:22 IEEE has a Standards Education Committee—a joint effort of its Educational Activities and Standards Association groups—dedicated to promoting the importance of standards in meeting technical, economic, environmental, and societal challenges, and to the integration of standards into academic programs throughout the world. Among its activities are an electronic magazine dedicated to standards education and a grant program for students and faculty mentors for application papers on the use of standards.

4:59 Today, when you can easily get light bulbs to fit your lamps and your ATM card works internationally in all ATM machines, it is hard to imagine a time when almost nothing was standardized.

5:11 Based on archeological relics discovered in Northern Africa and the Middle East, standardization can be traced back to the ancient civilizations of Babylon and early Egypt. The earliest standards were the physical standards for weights and measures. Over time, as trade and commerce developed, there evolved written documents that set mutually agreed upon standards for products and services such as agriculture, ships, buildings, and weapons. Initially, these standards were part of individual contracts between suppliers and purchasers. Later, the same standards came to be used across a range of transactions, forming the basis for modern standardization.

5:53 After the industrialization of the early nineteenth century, the absence of standardization caused significant inefficiencies and endangered public safety. We have already seen the consequences of the Baltimore fire in 1904. Some other examples from the early 20th century include inconsistent railroad track widths early on that caused delays when wheels had to be changed at connecting points, as well as dangerous boiler explosions in 1910 caused by excessive temperatures.

6:24 As time and technology progressed, so did standardization. Today, standards developers seek to achieve a great precision of uniformity since the smallest microdeviation from perfect tolerances can cause airplanes to malfunction or satellites to go off course.

6:44 In today's society, standardization provides order and convenience. It is the reason why our PCs and laptops can be networked, our phone calls are delivered, our power stays on, and so much more.

7:03 Over the past 100 years, standardization has expanded beyond manufacturing—to management, service industries, education, agriculture, and many other areas.

7:20 Standardization is the process that encompasses the initiation, development, and application of standards documents. It's the process of merging scientific research with applied experience to determine the precise, optimum technical requirements for an aspect of technology. The output of this merger is the authoritative document called a "standard."

7:44 Standardization is recognized as an essential discipline for all global marketplace players who must strive to be competitive. Today, companies have integrated standardization as a major technical and commercial element in business planning. They are aware that they must play an active role to assert their interests—or be prepared to accept standards established without them.

8:09 What exactly is a standard? *ISO/IEC Guide 2: 2004* defines it as "a document established by consensus and approved by a recognized body that provides for common and repeated use, rules, guidelines, or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context."

Let's use that as a working definition.

8:38 Standards address issues ranging from product compatibility to consumer safety and health concerns. Standards also simplify product development and reduce non-value-added costs, thereby increasing users' ability to compare competing products. Standards are the fundamental building blocks for international trade. Only through the use of standards can requirements for interconnectivity and interoperability be ensured and the credibility of new products and new markets verified—enabling the rapid implementation of technology.

9:16 Standards may be classified in many ways. We will discuss a few of the common classifications you will hear about, but there are others.

9:25 One type of classification concerns the subject of the standard. We can say that a standard is a "product standard," a "process standard," or a "service standard."

9:38 Product standards establish qualities or requirements for a product to ensure that it will serve its purpose effectively. Process standards specify requirements to be met by a process, such as an assembly line, in order to function effectively. Service standards, such as for repairing a car, establish requirements to be met in order to achieve the designated purpose effectively.

10:02 Another type of classification describes the content of the standard. We can say that a standard is a "design standard" or a "performance standard."

10:12 A design standard describes how a product should be made or defines the exact materials to be used. A performance standard defines how a product is expected to function after it is made. Such a standard may include methods for testing.

10:27 Another classification you may hear about is the distinction between a "de jure standard" and a "de facto standard."

10:35 De jure standards, also called formal standards, are developed by formal standards organizations using well-established procedures based on openness, transparency, balance, due process, and the right of appeal. Numerous formal standards organizations exist, such as ISO, IEEE, GB, ANSI, World Wide Web Consortium (W3C), ASTM International, Internet Engineering Task Force (IETF), and Health Level 7 (HL7), to name just a few. Among the thousands of de jure standards developed by these and other organizations are the IPv6 protocols of the IETF; IEEE 1800, System Verilog; and ISO 9000.

11:30 Some technical specifications developed outside the formal processes gain wide acceptance in the marketplace and become de facto standards as a result of many organizations and individuals adopting them.

11:43 Yet another classification scheme distinguishes between “voluntary standards,” which by themselves impose no obligations regarding use, and “mandatory standards.” There are many differences around the world in the definitions of voluntary and mandatory standards and the status of standards in government regulations.

12:06 Standards are important for many reasons. In essence, they are a common language for all stakeholders including the public; manufacturers; consumers; governments; businesses; and educators. They help lower the costs of implementation, training, manufacturing, and production. They help ensure safety, reliability, and acceptance.

12:31 Technology drives standards. Standards establish compatibility and interoperability; they make it easier to understand and compare competing products; they encourage innovation.

12:44 Economics drives standards. Standards speed the time to market for new products; they help reduce the risk of product liability; they enable competition.

12:56 International trade drives standards. The development of standards helps demonstrate social responsibility and reduces the need for regulation. In turn, standards facilitate international trade.

13:10 Globalization of markets will drive more emphasis on the economic component of standardization and a demand for a balanced approach across regions. Global markets require globally-relevant standards.

13:22 Remember, because standards are so important in industry, industry wants new engineers to know about standards. In this video, we have started to cover some of the basics: what standards are and why they matter to industry, and the different types of standards. But there is more. Take the time in your studies to learn about standards. Talk to your professors. Contact standards organizations in your field of interest. Contact your IEEE student organization if there is one on your campus.

14:00 Other videos in this series will cover additional topics in standards education such as the standards-development process and the part that standards play in global trade. We hope this video has made you eager to learn more!

Addendum

Assessment — Standards Education: An Introduction

STUDENT NAME: _____

CLASS: _____ **DATE:** _____

INSTRUCTIONS: Circle the responses you believe to be correct.

1. What does history tell us about standardization?

- A) It is a continually evolving process.
- B) It guarantees the longevity of political leadership.
- C) It is a process linked only to manufacturing.
- D) It is an unflawed process that rarely changes.

2. True or False:

Technology, globalization, innovation, and international trade drive 21st century standardization.

- A) True
- B) False

3. What is the difference between design standards and performance standards?

- A) Design standards describe how a product should look, whereas performance standards describe how well it should function.
- B) Design standards describe how a product should function, whereas performance standards describe how it should be made.
- C) Design standards describe how a product should be made, whereas performance standards describe how it should function.
- D) Design standards describe how stylish a product is, whereas performance standards describe how well it should function.

4. What is the difference between de facto standards and de jure standards?

- A) De facto standards are developed only by consumers, whereas de jure standards are developed by formal organizations using known processes.
- B) De facto standards address defects, whereas de jure standards address jury practices.
- C) De facto standards develop through wide use and market acceptance, whereas de jure standards are developed by start-ups to challenge de facto standards.
- D) De facto standards develop through wide use and market acceptance, whereas de jure standards are developed by formal organizations using known processes.

5. True or False:

Standards create competition, increased safety, and improved communication among stakeholders.

- A) True B) False

6. What role does consensus play in the development of standards?

A) Consensus plays no part in developing standards. Organizations like IEEE have the power and responsibility to create standards, so no consensus is needed.

B) Consensus plays a limited role in developing standards. IEEE and CNIS each develops standards, thus the two organizations must reach consensus.

C) Consensus plays only an implicit role in developing standards. The market is the final arbiter for standards, and market approval can be considered a form of consensus.

D) Consensus plays an integral role in developing standards. Members of recognized professional organizations establish standards through reaching consensus.

7. Which of the following is true of standards?

A) Standards discourage innovation because they require creators to work within boundaries.

B) Standards make it easier for consumers to compare products.

C) Standards impede globalization because they force the developing world to adapt to the developed world.

D) Standards make it more expensive to implement new products.

8. ISO, IEEE, GB, and ANSI are acronyms for:

A) Specific types of standards

B) Technical protocols

C) Standards development organizations

D) Standards development procedures

9. True or False:

The development of standards heightens the need for regulation within the context of international trade.

- A) True B) False

10. The absence of standardization can lead to

- A) Reduced innovation
- B) Product liability
- C) Declining consumer safety
- D) All of the above