Breaking it Down:
Flipping Library Instruction for Non-Traditional Undergraduate Engineers

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ACRL Information Literacy Frame: Authority is Constructed and Contextual

Discipline: Sciences & Engineering

Subject: STEM

Pedagogies: Flipped classroom learning; Brain-based learning

Special Populations: Non-Traditional Students; Undergraduate Students

When a faculty member stopped by for a quick question, we did not realize that it would develop into a months-long project to integrate information literacy into her undergraduate course. It all began when the faculty member won a National Science Foundation (NSF) grant to improve STEM education methods in a Bachelor of Science in Information Technology (BSIT) course.[1] Using the grant, the professor wanted to flip her classroom to help her students actively learn the professional skills necessary for their future careers, and she wanted the libraries to be involved. Because com-

bining the flipped classroom strategy with brain-based learning theory engages students in authentic and active learning experiences, we elected to incorporate brain-based learning theory into our BSIT work after several conversations with the professor and interactions with the students. Below we share how we deploy brain-based learning theory to create online learning modules and in-class instruction for non-traditional undergraduates.

Pedagogies: Flipped Classroom Learning and Brain-based Learning

Keeping in mind the challenges her students face, the professor flipped her course to offer a more effective learning strategy for her students. More instructors are flipping their classrooms due to advances in technology and availability of digital resources. Generally speaking, in a flipped classroom students are exposed to new material outside of class before engaging in active learning activities to assimilate that knowledge in class.[2] Using this flipped model, students perform passive activities at home, such as listening to lectures, then pursue active and authentic learning in class.[3] Authentic learning provides "lifelike, enriching, and appropriate experiences" to connect students with purposeful pursuits.[4] A challenge with flipped classrooms can be that students continue their "passive roles" in class because they are so accustomed to in-class lectures.[5] From our prior teaching experience in the BSIT program, the students retained their passive posturing and reluctantly participated in class discourse, which the professor forewarned. Increasing participation in class discourse was an area for improvement because communication skills are not only brain-friendly tasks but also help prepare students for workplace interactions.[6] Regardless of students' passivity, the professor was keen to flip her classrooms to accommodate students' busy work and personal schedules.

Authentic learning is also a hallmark of brain-based learning. Brain-based learning prompts educators to individualize instruction to students and their unique brains, and to acknowledge that real-world elements such as intellect, creativity, emotions, and physiology impact learning.[7] To engage the whole brain, educators can demonstrate a positive attitude.[8] They can play upbeat music, incorporate bright colors into instruction, and encourage physical activities to increase blood flow to students' brains.[9] Moreover, brain-based theory works well with information liter-

acy instruction.[10] As Cook and Klipfel argued, librarians should incorporate brain-based learning and cognitive psychology into instruction to better equip students to learn, remember, and transfer information literacy skills to the real world.[11] Throughout this project, we considered how non-traditional students' learning in a flipped classroom could be impacted by key characteristics of brain-based learning, particularly narrative, authenticity, and emotion. To coincide with course redesign for the NSF grant, we designed the library session and materials to relate to students' professional lives, authenticating their individualized educational experience.[12]

In order to create authentic learning opportunities, we want to avoid "busy work." When planning for this, we first considered format. Though videos are popular for flipped classrooms, it can be difficult to locate quality, relevant videos.[13] Additionally, BSIT students already watched taped lectures, so we did not want to overload them with too many videos. We next considered the depth of knowledge to convey through learning materials. In terms of Bloom's taxonomy, pre-class content should engage students to remember and understand concepts, while in-class materials require students to engage in higher order thinking skills, such as apply, analyze, evaluate, and possibly create information.[14] A major hurdle for some college students, besides not enjoying reading, is they are not equipped to read scholarly information critically.[15] Building off other flipped course designs that emphasized critical reading, we decided to create online printable guides for facilitating critical reading and use of scientific articles and industry computer science standards for their final project.[16]

We designed the printable guides using brain-based learning theory, particularly focusing on how patterns impact learning. Hart, who developed the "programmed structures" or the "proster" theory of the brain, defined learning as "the extraction, from confusion, of meaningful patterns."[17] Hart broke this into two fundamental processes: pattern seeking and program-building.[18] The human brain engages in such processes because it does not learn by linear logic but by recognizing patterns in our chaotic world.[19] We use these patterns to organize the information around us. We then make larger patterns out of the smaller ones in order to understand information.[20] In other words, we are able to move and store new information from our short-term memories into our long-term memories by associating new information with prior knowledge.

However, this does not mean that students thrive in chaos. Rather, according to a more specialized branch of brain-based theory, cognitive psychology, we parse information into digestible "chunks." Chunking, according to Daniel T. Willingham, is "the phenomenon of tying together separate pieces of information from the environment."[21] By chunking, students are able to hold more information in their short-term memories, maximizing knowledge to convert into long-term memories.[22] Instructional goals are to never overload students with too much information at once and to make the information as authentic or relevant as possible.[23] Our guides outline a hierarchical ordering of chunked information. Each addresses the two different source types and their components. In the scientific article guide (Appendix 49A), for instance, we detail the order of an article, identify contents of the abstract, introduction, and discussion, and delineate the most effective and efficient way to read an article. Essentially, we teach students how to chunk relevant sources.

Showing students how to accomplish a task is one (passive) thing, but getting them to retain information about that task is much more complicated. Our design, using brain-based theory, reinforces the intellectual and emotional engagement necessary to learn. First, we order information through bright colors and geometric shapes. Geometric shapes help conjure associative memories, so we clumped and distinguished article elements into squares before reordering the elements into a recommended reading pattern. Students, developing their own type of programmatic response, or "fixed sequence" of learning, are empowered to read materials to recognize an order of operations for reading and understanding different source types.[24] Bright colors also stimulate memory-building emotions. The use of bright orange and yellow with a little bit of red, for instance, can help readers feel happy and awake. Learners associate new information with positive memories in order to better integrate it into long-term memory.[25] Creating positive emotions help counter students' stress, which is essential to learning. Stress can shut the brain down so much so that a person will not be able to communicate.[26] This is not the reaction we want from students.

To further prompt communication and learning, we injected a little humor. Our colorful comic strip (Appendix 49D) focuses on the production of two scientific articles. In the cartoon, one article author is an expert in the field and another an "expert" in watching scientific television. One toils over writing and researching while the other uses Massachusetts In-

stitute of Technology's SCIgen program to generate a computer science paper—with both being published in reputable journals.[27] Because the tale of two scientists is an example of an authentic narrative based on experience, it prompts students to question the authority, credibility, and expertise of academic sources. We turned to narrative because stories capture our interest and our emotions. Theoretically, humans have a unique psychological preference for remembering narrative because stories are "humanistically and scientifically central to the human experience and memory."[28] Not to mention that the audacity of someone being able to publish a fake research paper is as laughable as it is troubling for their profession. Through their laughter, students can begin to question the authority of academic experts and prepare for our in-class information literacy instruction.

Our in-class instruction builds upon and assesses students' prior knowledge acquired through pre-class activities and supports whole brain engagement with the materials. While developing prior knowledge is an essential element of flipped classrooms, we also scripted brain-backed methods of repetition, playing music, and getting students to move around, thus increasing oxygen levels in their brain and their ability to learn.[29]

ACRL Information Literacy Frame: Authority is Constructed and Contextual

We integrated the flipped classroom and brain-based learning with the Association of College and Research Libraries (ACRL) frame, Authority is Constructed and Contextual, in order to create our pre-class and in-class materials and activities.[30] We were drawn to this particular frame because its knowledge practices spoke to the needs of the students for authentic educational experiences. As working professionals and returning learners, BSIT students routinely work with "different types of authority" in their field, ranging from their work colleagues to their professors.[31] We hoped our lesson plan will encourage students to recognize themselves as authorities in their field and to foster the connection between students' professional and educational lives. For example, the pre-class items provide readers with tips for understanding and using authoritative sources in their field and overtly remind them that they are the future experts in their field.

To help students cross the conceptual threshold to "creating new knowledge and participating ethically in communities of learning," we used the

frame to define a series of learning outcomes and activities for our in-class session.[32] First, emphasizing the ACRL frame of Authority is Constructed and Contextual, we ask students to recall pre-class activities through a brief class discussion. Next, students break into groups of three or four students. In groups, students reflect on the qualities of "good" scientific research. We encourage them to think of industry standards as well as trade, popular, and particularly academic sources they have used in school and at work, reasoning why they found the sources reliable. We prompt them to focus on author and publication credentials to determine what constitutes "good" scientific research. Then, as a class, the students solidify a rubric to evaluate scientific articles and industry standards for the next portion of the class. If needed, we suggest that an author's credentials are determined through institutional and other affiliations, educational and professional background, and previous publication history. Other suggestions include that resources are evaluated on organizational associations, importance to the field, publisher, and presence in *Ulrichsweb* serials directory. Once the criteria are set, students conduct blind reviews of industry standards, real scientific articles, and SCIgen-generated papers. While music plays, groups walk between stations with different sources, evaluating the authority of the author, sponsoring association if applicable, and the resource as a whole. With the music stopped, students then discuss their findings with the class, reflecting on their authority to evaluate the author and resource as students and professionals.

Our intent during the above process is to prompt students to "acknowledge they are developing their own authoritative voices" in the field of computer science and engineering so that they will be confident in their ability to participate in the social and intellectual development and challenging of their industry's standards.[33] Being able to do so impacts their ability to complete their required coursework. For instance, the final project for the semester requires students to write a Software Project Management Plan and Software Requirements Specification based on scientific literature and information technology industry standards.

As a final portion of the in-class activities, students form new groups to compete in citation mapping. Starting from one article related to their coursework, students will chain citations forward and backward using *IEEE Xplore*. By doing so, students understand how peer approval creates authority while learning how to use a relevant database to effectively research. To win the citation game, groups must trace citations forward and backward by

manually researching and identifying at least thirteen sources. Found sources must share a common topical thread to the original source. Students must locate at least two sources for every one item and be able to justify their selection. Again, students reflect upon their findings with the larger group. At the end of the session, students complete the posttest for the online modules, which mirror the pretests they take before reviewing pre-class assignments.

Lesson Plan

Learner Analysis

This lesson works well for transfer or non-traditional students who are also working professionals in need of engaging and relevant information literacy instruction that will benefit their careers and save time.

Limitations
- Transfer or non-traditional students typically have restrictive schedules and are balancing work, school, and their personal lives.

Opportunities
- We have observed students are highly motivated to succeed in school to benefit their present and future careers.
- Computer science students are already acquainted with the design and function of databases, reducing the need to acclimate them to library databases and Boolean logic.
- Students may bring their professional work experience into the classroom, which helps make their learning experiences more authentic.

Orientating Context and Prerequisites

Pre-instruction learner tasks
- Take pre-quiz on reading scientific articles (Appendix 49E).
- Read "Breaking it Down: Scientific Articles" (Appendix 49A).
- Take pre-quiz on engineering standards (Appendix 49E).
- Read "Breaking it Down: Industry Standards" (Appendix 49B) and "Breaking it Down: Making Industry Standard" (Appendix 49C).
- Take pre-quiz on the construction and contextualization of authority (Appendix 49E).

- Read "Breakin it Down: Who's the Real Expert" cartoon (Appendix 49D).

The pre-assignment materials are designed to prompt recognition and remembrance of formatting patterns, better enabling students to efficiently and effectively research and read materials relevant to their course and professional information needs. To provide greater context for the creation of industry standards, we also have a roadmap to standards, which detail which individuals and organizations contribute to the creation and review process of industry standards (Appendix 49C). Additionally, a short comic strip about the production of a scientific article questions the authority of two fictional authors (Appendix 49D). Each component has a pretest and posttest to encourage active engagement and self-reflection to assess students' learning.

Instructional Context

The essential elements of this lesson plan include all the pre-class modules, the corresponding in-class modules, and the post-class assessment. The optional element is the in-class citation mapping activity. Because this is a flipped classroom, students should perform the pre-class modules prior to the in-class library session (Tables 49.1–49.3). Each of the three pre-class modules should take a total of ten to fifteen minutes. Although each element of the module is online, the components may also be printed and distributed to students. The in-class session requires fifty minutes of hands-on learning. The optimal class environment will have the technology to allow the instructor to play music audible to students and contain a whiteboard or chalkboard. Ideally, students will also have access to a device with an internet access (computer workstations, personal laptop, tablet, or smartphone). However, the essential element to a successful activity would be simply a whiteboard or chalkboard. The design of this activity centers on stimulating the students' whole brain by activating many senses, such as their hearing, touch, or vision.

Learning Outcomes and Learning Activities
Learning Outcomes

1. Identify and explain the components and purpose(s) of a scientific article.

2. Identify and explain the components and purpose(s) of a standard.
3. Feel comfortable critiquing "well-known authoritative scholars and publications."
4. Be aware of the various authorities that create and establish industry standards.
5. Understand they are "developing their own authoritative voices" to participate in the information ecosystem.
6. Understand the "social nature of the information ecosystem" in which authors actively draw upon past and current scholarship and professional/academic networks for new knowledge creation.

Learning Activities

Tables 49.1–49.5 describe the learning outcomes and activities for this lesson. The pre-class modules are made to be autonomous. Each pre-class module could be used on its own and in different courses. Also, the citation mapping is meant as an autonomous activity and could be used in conjunction or separately from the reset of the materials presented here.

TABLE 49.1: PRE-CLASS ACTIVITY—WEEK 1				
Scientific Article Module			**Learning Outcomes**	**Time**
	Material	"Breaking it Down: Scientific Articles"; print or electronic		
	Assessment	Pre-quiz—Scientific Article Assessment (Appendix 49E)		5 mins
	Instructional Activity	Read through "Breaking it Down: Scientific Articles" (Appendix 49A).	Identify and explain the components and purpose(s) of a scientific article.	5–10 mins
				10–15 mins

Table 49.1. This table matches the ACRL frame, Authority is Constructed and Contextual, with the associated learning outcomes and supportive pre-class activity for Week 1.

TABLE 49.2: PRE-CLASS ACTIVITY—WEEK 2

Standards Module			Learning Outcomes	Time
	Material	"Breaking it Down: Making of Industry Standards"; print or electronic "Breaking it Down: Industry Standards"; print or electronic		
	Assessment	Pre-quiz—Standards Assessment (Appendix 49E)		5 mins
	Instructional Activity	Read through the "Breaking it Down: Making of Industry Standards" and "Breaking it Down: Industry Standards."	Identify and explain the components and purpose(s) of a standard.	5–10 mins
				10–15 mins

Table 49.2. This table matches the ACRL frame, Authority is Constructed and Contextual, with the associated learning outcomes and supportive pre-class activity for Week 2.

TABLE 49.3: PRE-CLASS ACTIVITY—WEEK 3

Authority Module			Learning Outcomes	Time
	Material	Comic strip, "Knowledge Engineered"		
	Assessment	Pre-quiz—Authority is Constructed and Contextual Assessment (Appendix 49E)		5 mins
	Instructional Activity	Read through the comic strip, "Knowledge Engineered."	Identify and explain the components and purpose(s) of a standard.	5–10 mins
				10–15 mins

Table 49.3. This table matches the ACRL frame, Authority is Constructed and Contextual, with the associated learning outcomes and supportive pre-class activity for Week 3.

TABLE 49.4: IN-CLASS ACTIVITY—WEEK 4			
Scientific Article, Standard, and Authority Modules		**Learning Outcomes**	**Time**
	Material	Upbeat music; 4 stations with one scientific article or industry standard each; whiteboard; laptops or computer lab; class-made evaluation rubric		
	Instructional Activity	1. Play upbeat music as students enter the room.		
		2. Facilitate a group discussion to recap what students remember from the pre-class activities and create an evaluation rubric for scientific and standard publications on the whiteboard for everyone to see.	Feel comfortable critiquing "well-known authoritative scholars and publications." Be aware of the various authorities that create and establish industry standards.	10 mins
		3. Have students evaluate each scientific articles and industry standards by rotating through all 4 stations according to the class rubric.		20 mins
		4. Play upbeat music during group activities.		
		5. Facilitate a group discussion on the results of the students' evaluations.	Understand they are "developing their own authoritative voices" to participate in the information ecosystem.	10 mins
		6. If needed, have students search databases.		10 mins
				50 mins
	Assessment	Post-quiz—All questions after class session		15 mins

Table 49.4. This table matches the ACRL frame, Authority is Constructed and Contextual, with the associated learning outcomes and supportive in-class activities for Week 4. Direct quotations are taken from the "Knowledge Practices" under the ACRL frame, "Authority is Constructed and Contextual. The BSIT class periods are three hours, which allows for ample instructional time; however, the required in-class activity is timed out for a fifty-minute instructional session.

TABLE 49.5: IN-CLASS ACTIVITY (OPTIONAL)—WEEK 4			
Scientific Article, Standard, & Authority Modules		**Learning Outcomes**	**Time**
	Material	Upbeat music; 4 stations with one scientific article or industry standard each; whiteboard; laptops or computer lab; class-made evaluation rubric		
	Instructional Activity	1. Pass out an article to each group that pertains to the course topic.		
		2. In groups, have students do citation mapping in *IEEE Xplore*.	Understand the "social nature of the information ecosystem" in which authors actively draw upon past and current scholarship and professional/ academic networks for new knowledge creation.	
		3. Play upbeat music while students do the activity.		20 mins
		4. Facilitate group discussion on citation mapping results.		10 mins
		5. Allow students time to do searching for their own projects.		20–30 mins (optional)
				30–60 mins
	Assessment	Post-quiz—Authority is Constructed and Contextual		5 mins

Table 49.5. This table matches the ACRL frame, Authority is Constructed and Contextual, with the associated learning outcomes and supportive in-class activities for Week 4. Direct quotations are taken from the "Knowledge Practices" under the ACRL frame, "Authority is Constructed and Contextual. The BSIT class periods are three hours, which allows for an additional optional activity. The activity is timed for 30-60 mins of instruction. The optional activity can be adapted as a stand-alone activity during another class period or for a post-class assignment.

Assessment

Assessment plays an important role in determining what students learn and retain and is a requirement of the faculty member's NSF grant. Following brain-based methods, we provide immediate feedback during assessment, essential to helping learners discern the effectiveness of their "pattern recognition and extraction," through course management system quizzes.[34] The tests avoid the dichotomy of right/wrong answers, giving students partial credit for recognizing one correct component if not all in multiple-choice questions.[35] This encourages students on the right path and prevents feelings of "failure." Pre- and posttests (Appendix 49E) assess four concepts:

1. understanding the structure and purpose of a scientific article and its components
2. understanding the roles published scholarly work and students as professionals play in scholarly conversation
3. understanding the structure and purpose of a standard and its importance to engineering
4. understanding the contextual nature of authority

The students take the pretests before they start the associated online module while they take the posttest after the completion of in-class activities. Each test contains the same three randomized multiple-choice questions to assess student improvement when comparing test scores. We also consider students' answers to open-ended reflective answers in each quiz and their integration of these concepts in their course project. Open-ended questions encourage student-narrated reflection of the lesson. The mix of open and multiple-choice questions makes assessment authentic because it allows students to relate course materials to their own lived experiences, increasing their engagement.[36] To supplement the quizzes, we will also use our in-class instruction as an opportunity to observe students' learning and to solicit feedback regarding pre-class materials from students and will make adjustments to our lesson plan accordingly.

Beta Mode Glitches and a Look into the Future

As we implement the beta mode version of the course redesign, we will continue to modify the content for our lesson plans based on instructor and peer feedback. The greatest challenge to integrating information lit-

eracy into this course, perhaps, has been being able to find common time with the professor to meet and discuss the project. Through our face-to-face meetings and the occasional email, we have been able to develop and continue to edit our lesson plan to meet the needs of the professor and students, which includes designing the materials so that the instructor could lead the instructional session without the librarian present if necessary. Finally, if the students make it clear that we are not as funny as we think we are, we will change our punch lines.

Appendix 49A

BREAKING IT DOWN: SCIENTIFIC ARTICLES

by karna younger & rebecca orozco

TITLE: an at-a-glance idea of article relevancy

FIRST AUTHOR: lead of the study, principal investigator of study
LAST AUTHOR: principal investigator of research/laboratory group

ABSTRACT

Scholarly or peer-reviewed articles begin with an abstract. Each journal has its own style for abstracts. An abstract may be bolded or italicized, or unlabeled. It summarizes the hypothesis, methodology, and key results. An abstract also relates the importance of study to relevant scientific literature.

RESULTS

- findings or results
- text & visuals (pictures, equations, graphs & tables)
- insignificant results may only be in the text

CHECK OUT DATA VISUALS FOR STATISTICAL INFORMATION NOT FOUND IN THE TEXT

INTRODUCTION

- gives background and context
- reviews recent, relevant and seminal research
- one to several paragraphs
- hypothesis at the end: "authors hypothesize" or "this study investigates"

Discussion

- must read to understand the article
- gives context: compares & contrasts results with previous studies
- explains how results confirm or contradict current prominent theories
- limitations and scope of the experiment (again)

METHODS

- labeled methods or something more specific
- dense
- explains techniques & standards
- protocols from this and other studies
- study's scope and limitations
- purpose: to help you replicate and validate the results

Conclusion

- final & brief summary
- important implications & areas for future study
- get ideas for your research here
- no time? read the abstract, skim the introduction and discussion, and skip the conclusion

READ SCIENTIFIC ARTICLES IN THIS ORDER

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Shortcut: abstract, introduction & discussion

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Appendix 49B

BREAKING IT DOWN:
Industry Standards Road Trip
by rebecca orozco & karna younger

What is a standard?

"Published documents that establish specifications and procedures designed to maximize the reliability of the materials, products, methods, and/or services people use every day." (IEEE Standards Association, n.d.)

Why all the fuss?

- consumer safety and public health are important
- companies quickly develop products to make $$$

Where do standards start?

Standards Developing Organizations (SDOs)

- International & national SDOs
- Local, state, or federal governmental bodies adopt standards as law
- Countries can push politics in SDOs

Who navigates?

- International Organization for Standardization (ISO)
- United States Standards Strategy (certifies all American SDOs)
- IEEE Standards Association
- Professional societies (International Electrotechnical Commission)

What's their route?

(Long) Approval Process

- An org. sponsors a standard & gathers a working group to draft it
- An SDO moves the standard to ballot, a review committee okays it, and then the the whole gang votes. IOS requires a 75% approval.

Who does this drafting and voting?

- Volunteers
- SDO members and scholars from public and private sectors
- Ex., professionals, professors, government workers, & future you

ROAD WORK

Travel Tips

- Check standards for active status
- Read a standard's forward for its approval process
- Check out our works cited & consulted: https://goo.gl/oqUWNC

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https://magic.piktochart.com/output/19221751-bsitindustry_standards

Appendix 49C

BREAKING IT DOWN: INDUSTRY STANDARDS

by karna younger & rebecca orozco

THIS GUIDE
- Overviews features of a standard
- Identifies layout & purpose of standard's comments
- Shows how to skim a standard

TITLE PAGE
- Title format: introductory element – main element – complementary element
- Standard level: international, regional, or national
- Standard number: Standard Developing Organization (SDO) and series number
- Active or inactive: check the edition and date

SCOPE
- Identifies what the standard is used for and who should use it
- Tells how the standard should be applied (provides context)
- Pay attention to "specifies," "establishes," "gives guidelines for," & "defines terms"

REFERENCES
- Cites relevant sources
- References with a date point to specific standards' versions
- References without a date refer to a standard in general
- A tool to learn standards and series in specific engineering fields

TERMS
- Clarifies jargon
- Skim for words you don't know
- Bookmark it as a reference for reading the standard

HOW TO
- 1. Review standard's appendices for templates and supplemental material
- 2. Search the web for how a standard is used in real life
- 3. Dive into a standard's body to clarify sections of the standard template

TIPS
- If a section is blank, it isn't applicable
- IT companies may create their own documents based on standards
- Pull keywords from your company documents to find relevant standards

READ STANDARDS IN THIS ORDER

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https://create.piktochart.com/output/19987454-bsit_readindustrystandard20170205

Appendix 49D

https://magic.piktochart.com/output/19619135-bsitauthoritycartoon2017

Appendix 49E
Assessment

Scientific Article

1. Which of the following choices best describes what would be found in a methods section?
    a. Procedures and protocols, study parameters, and study limitations
    b. Background information related to the study
    c. Protocols and procedures, study information, and study failures
    d. Number of replications, study parameters, procedures and protocols, study limitations
    e. All of the above, except for B

2. What component of a scientific article relates the relevance of results and limitations of a study to the broader scientific literature?
    a. Conclusion
    b. Introduction
    c. Discussion
    d. Results
    e. None of the above

3. Why do think scientific articles are important to your work or experience as a student?

Industry Standards

4. How would you rate your comfort level with effectively understanding and using an industry standard in class or at work?
    a. Extremely familiar. I read these things for breakfast.
    b. Moderately familiar. I use them when necessary and do just fine.
    c. Somewhat familiar. I try to muscle through it but would like to know some tips.
    d. Slightly familiar. I have read an industry standard but have yet to use one.
    e. Not at all familiar. I have never read or used an industry standard.
5. Who creates an industry standard?
    a. Working professionals: between the hours of 9–5
    b. University professors: in the wee hours of the morning
    c. Professional organizations: members of IEEE or some other acronym
    d. Government agencies: Big Brother knows how to standardize
    e. All of the above: it's a party and everyone is invited
6. Why do you think having standards is important to fields of engineering and computer science?

Authority is Constructed and Contextual

7. Team leaders for an agile software development team and a front-end development met to discuss a client's needs. They have requested that you, as the intern, help to find the latest resources related to most efficiently and effectively implementing agile software development teams. Where would you look for this information?
    a. Trade publications: *Wired*
    b. IEEE standards: agile software development
    c. Scholarly publications: *IEEE Wireless Communications*

    d. Google: Manifesto for Agile Software Development
    e. A, C, and D
8. While researching in the IEEE Xplore, you find a scholarly article. Judging by the abstract, it might be relevant to your research, but you have never heard of the authors before. How do you determine if the article is authored by trustworthy sources in your field of study?
    a. Go with it. IEEE Xplore is a reliable database and they always vet information before indexing it.
    b. Google: Do the authors work in academia or publishing? Where? Have they ever published before? If so, where? Who are these people, really?
    c. Google Scholar: Check how many times the article has been cited by others. This is the quickest way to check authors' cred.
    d. Citation chaining: Plug the authors' sources into Google Scholar, Web of Science, or IEEE Xplore database to make certain the cited works exist and are well cited.
    e. B, C, and D
9. In your field of work, who do see as authority figures in your field and why?

Notes

1. At the University of Kansas, the BSIT program is located within the Department of Electrical Engineering and Computer Science in the School of Engineering. University of Kansas, "Center for Teaching Excellence leads $2.5 million NSF grant," press release, (2016), https://news.ku.edu/ku-center-teaching-excellence-leads-25-million-nsf-grant.
2. Linda Cresap, "Preparing University Students for Flipped Learning," *Implementation and Critical Assessment of the Flipped Classroom Experience*, ed. Abigail G. Scheg (Hershey, PA: IGI Global, 2015), 177–78.
3. Ibid., 182–83; Clyde Freeman Herreid and Nancy A. Schiller, "Case Studies and the Flipped Classroom," *Journal of College Science Teaching* 42, no. 5 (2013): 62.
4. Renate N. Caine and Geoffrey Caine, *Making Connections: Teaching and the Human Brain* (Alexandria, VA: Association for Supervision and Curriculum Development, 1991), 8.
5. Leslie A. Hart, *Human Brain & Human Learning* (Kent, WA: Books for Educators, Inc., 1999), 265; Cresap, "Preparing University Students," 180–82.
6. Hart, *Human Brain*, 315–16.
7. Caine and Caine, *Making Connections*, 8–9.
8. Ibid.
9. Ibid., 82–83; Michael L. Slavkin, *Authentic Learning: How Learning about the Brain Can Shape the Development of Students* (Lanham, MD: Scarecrow Education, 2004), 40–43; Jeremy Moore

and Tracy Sellers, "Practical Applications of Brain-based Strategies to Enhance Learning" (presentation Polk County Public School Training, Polk County, FL, 2006**).**

10. We define information literacy instruction by the Association for College & Research Libraries' *Framework for Information Literacy in Higher Education*. See Association of College and Research Libraries, *Framework for Information Literacy for Higher Education*, 2016, http://www.ala.org/acrl/standards/ilframework.

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22. Ibid., 34–40; Slavkin, *Authentic Learning*, 115.

23. Willingham, *Why Don't Students Like School?*, 34–40; Slavkin, *Authentic Learning*, 40–43, 115.

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29. Slavkin, *Authentic Learning*, 40–43; Moore and Sellers, *Practical Applications of Brain-based Strategies*.

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31. Association of College and Research Libraries, 2016.

32. Association of College and Research Libraries, "Framework for Information Literacy; Tables 1–5."

33. Association of College and Research Libraries, *Framework for Information Literacy*.

34. Hart, *Human Brain*, 316.

35. Ibid., 316–17.

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