

Aligning Skills, Competency Frameworks, and Learning Outcomes

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September 14, 2021

SREE Summer Fellow

University of California, Irvine

Funding provided by the *Bill & Melinda Gates Foundation*

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Outline

- **Introduction**
- **Background: 21st Century Skills**
- **RQ1**
- **RQ2**
- **Discussion and Next Steps**

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- The digital age is ushering in a competitive global economy, shifting the need for employees with sophisticated and refined competencies

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- Universities and colleges—are increasingly tasked with training the next wave of workforce entrants
- The success of this training is measured by growth in a broad range of abilities often labeled as 21st century skills.

Background: Enter 21st Century Skills

- Organization for Economic Co-operation and Development (OECD) approach to organize 21st century skills:
 1. Cognitive Skills
 2. Intrapersonal Skills
 3. Interpersonal Skills
 4. Technical Skills

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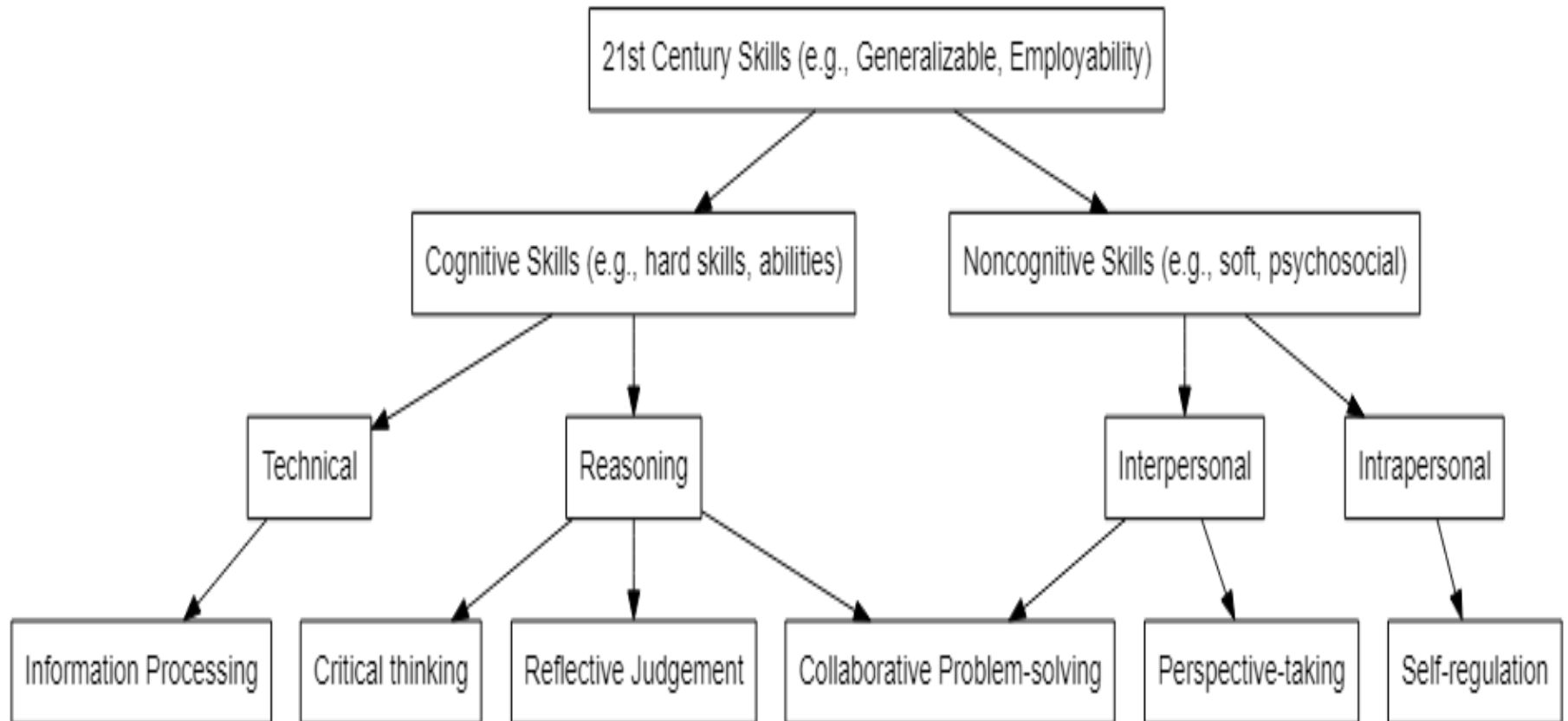
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- Employability skills?

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 1. **The Skills Gap**
 2. **Gainful Employment**

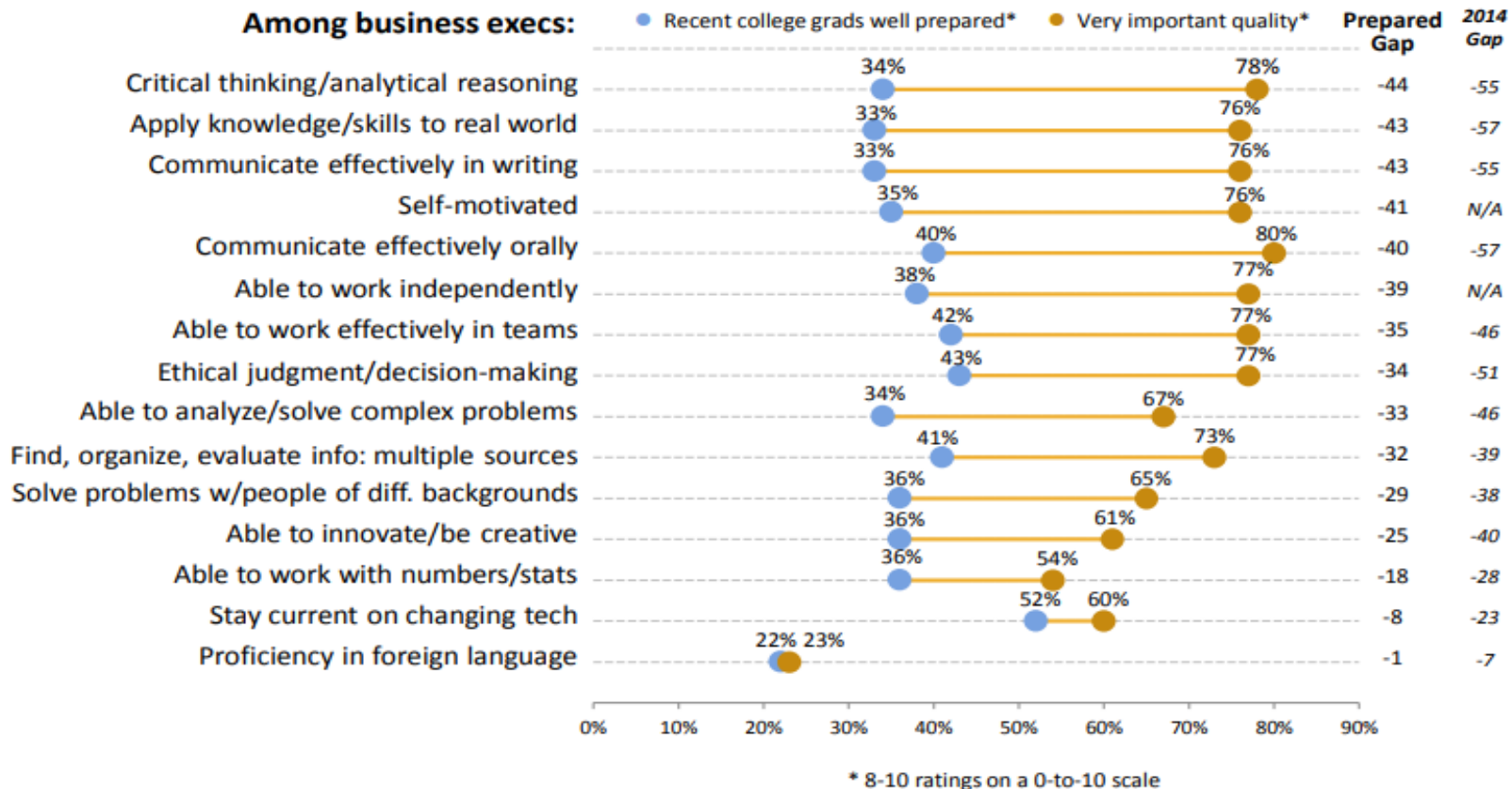
Background: The Skills Gap

- The skills gap is defined as the discrepancy between the skills employers need and require and those possessed by job candidates and employees.



Hart Research Associates, 2018

Notable gaps emerge between the importance of key learning outcomes and executives' sense that recent graduates are prepared in these areas, even with some improvements.



In collaboration with
Tata Consultancy Services



Closing the Skills Gap: Key Insights and Success Metrics

WHITE PAPER
NOVEMBER 2020



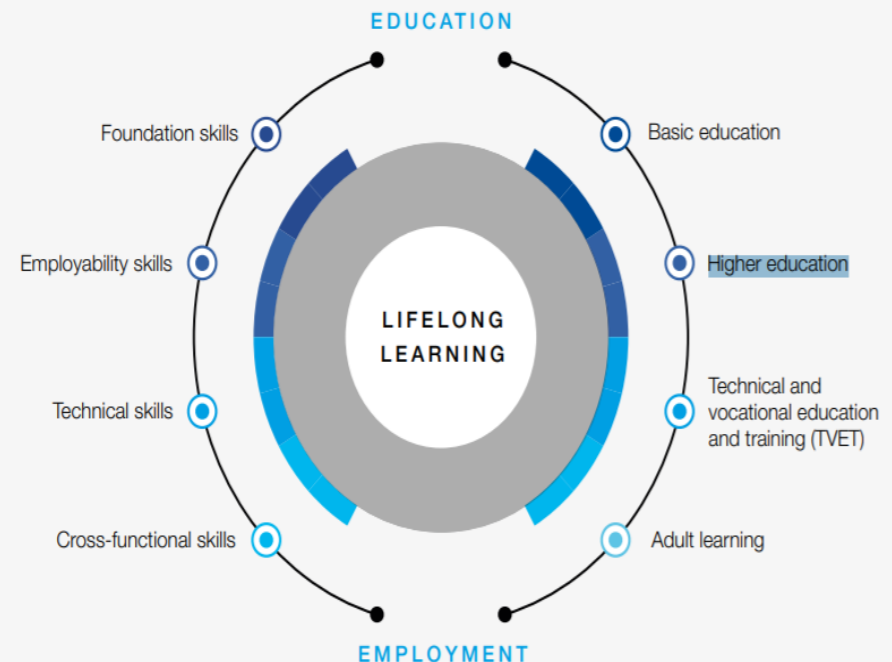
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Source: World Economic
Forum and Tata Consultancy
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FIGURE 1

Closing the Skills Gap 2020 Business Commitment Framework



Background: Gainful Employment

- Gainful employment is when:
 - (a) wages cover more than their living expenses, providing additional income that can either be saved or spent on non-essentials (often referred to as disposable income);
 - (b) opportunities for advancement and career building are clear and available;
 - (c) stability and working conditions are safe and reasonable



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- **Four-year Colleges:**
 - Expansion/Revision of liberal education to include *practical skills* in Liberal Education and America's Promise
- **Community Colleges:**
 - Adapt their success metrics and publicly available scorecards to account for the re-skilling of working professionals (“Skill builders”)

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- b) **RQ2:** What evidence is there of a unified framework that seeks to move beyond traditional academic metrics, and more directly communicate the skills students have acquired to employers?

RQ1: Evidence of a common language

Do Employers and Educators Speak the Same Language?

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YES

RQ1: What employers are saying

Fulfilling the American Dream: Liberal Education and the Future of Work

*Selected Findings from Online Surveys
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Conducted on Behalf of



with support from



July 2018



1724 Connecticut Avenue, NW
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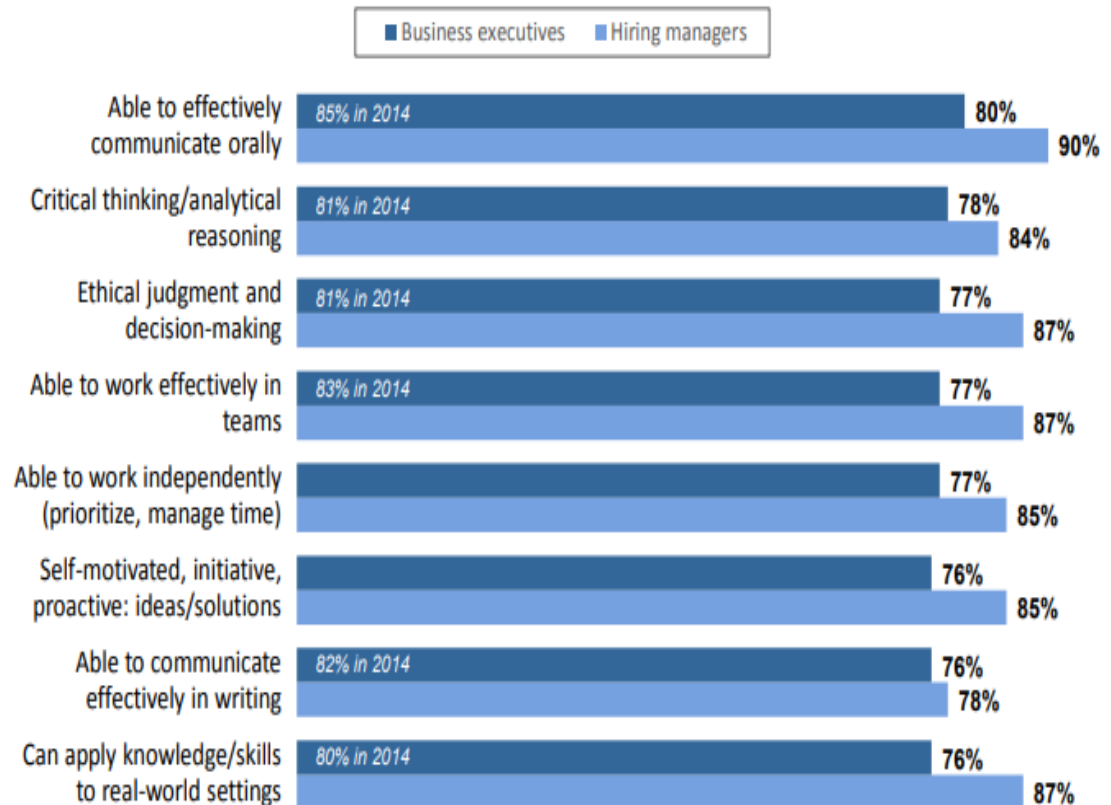
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The learning priorities that executives and hiring managers value most highly cut across majors.

Very Important Skills for Recent College Graduates We Are Hiring*



* 8-10 ratings on a 0-to-10 scale; 15 outcomes tested

UCI RQ1: What Educators/Scholars are saying

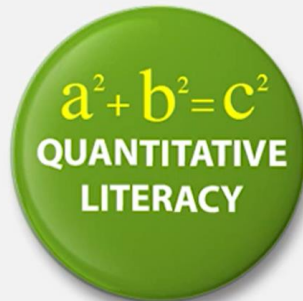
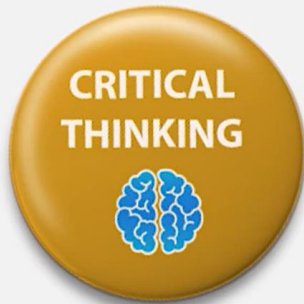


- Teamwork
- Goal setting
- Time management
- Emotional skills
- Interpersonal communication
- Social skills
- Leadership
- Problem solving and decision making

UCI

RQ1: What Educators/Scholars are saying

The *HElghten*® Outcomes Assessment Suite



RQ1: Rios, J. A., Sparks, J. R., Zhang, M., & Liu, O. L. (2017). Development and validation of the written communication assessment of the HEIghten outcomes assessment suite. *ETS Research Report Series*, 2017(1), 1–16.

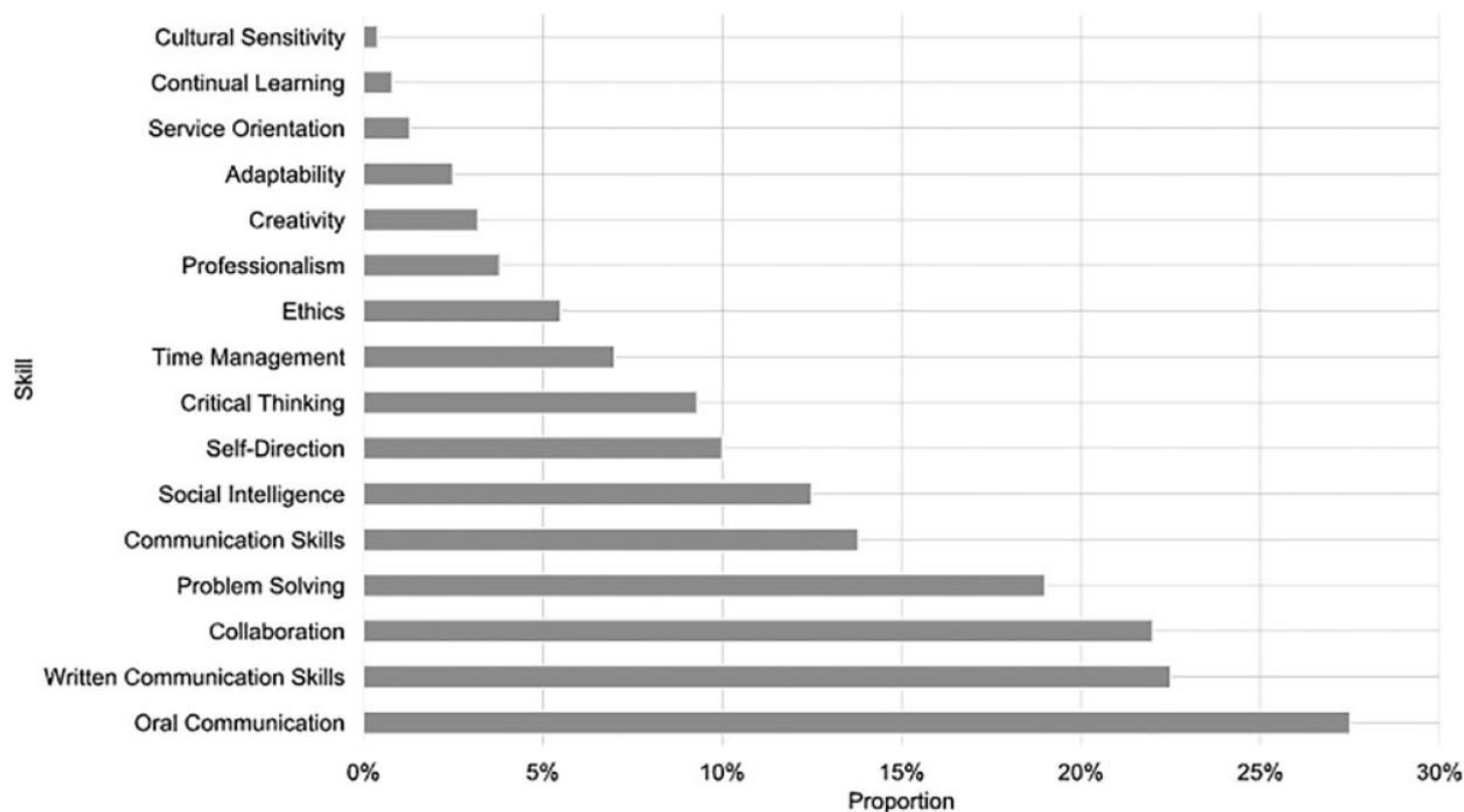


FIGURE 2. 21st-century skill demand expressed as proportion of total job advertisements examined.

RQ1: Vista, A. (2020). Data-driven identification of skills for the future: 21st-century skills for the 21st-century workforce. *Sage Open*, 10(2), 2158244020915904.

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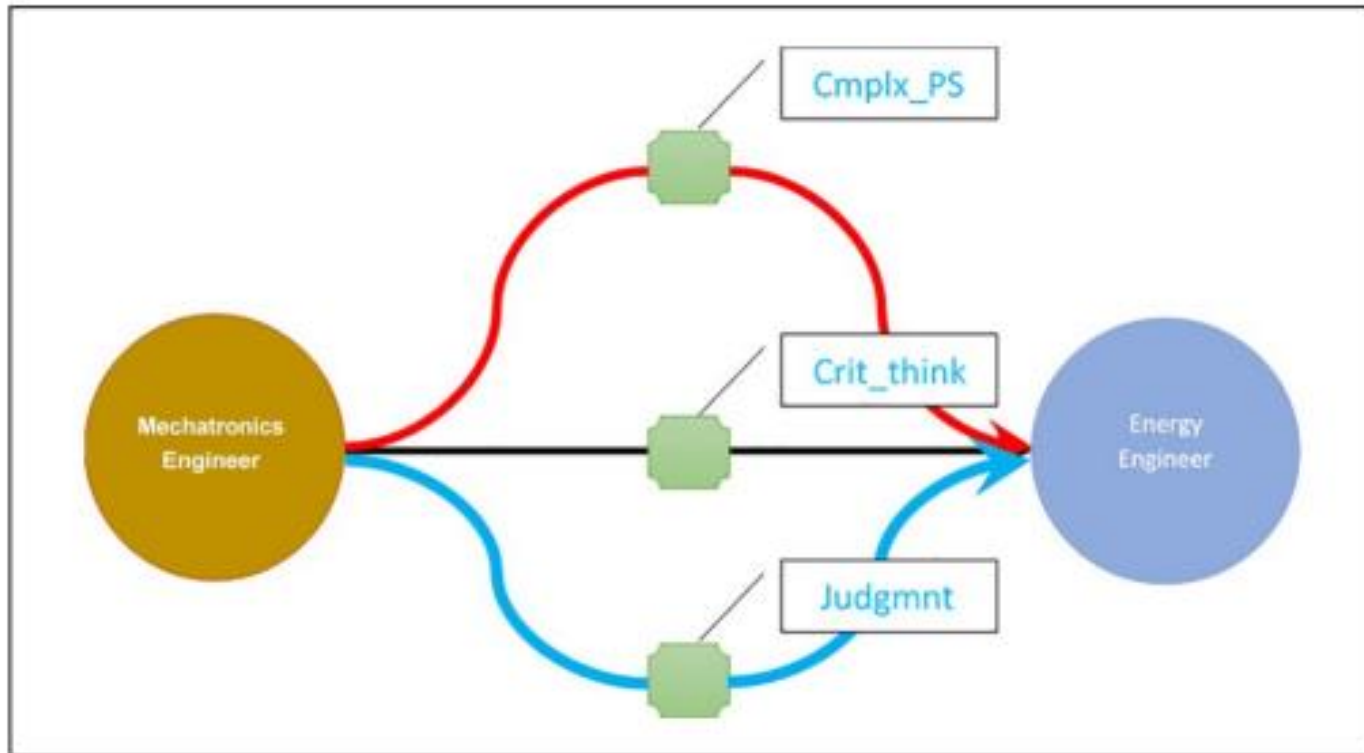


Figure 4. Visualization of a specific transition, where path thickness represents edge weight in a weighted network.

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Table 5. Comparison of Skill Rankings Across Broad Occupation Groups.

Rankings of transferability value	AEO group	SSO group	PO group
1	Problem sensitivity ^{AC}	Social perceptiveness	Manual dexterity
2	Visualization ^C	Problem sensitivity ^{AB}	Problem sensitivity ^{BC}
3	Judgment and decision making ^{ACW}	Fluency of ideas ^{AWF}	Critical thinking ^{WF}
4	Complex problem solving ^{ACWF}	Complex problem solving ^{ABWF}	Visualization ^C
5	Fluency of ideas ^{AWF}	Judgment and decision making ^{ABW}	Judgment and decision making ^{BCW}
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7	Flexibility of closure ^{ACW}	Negotiation ^W	Flexibility of closure ^{BCW}
8	Selective attention	Visualization	Social perceptiveness ^C
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Note. AEO = architecture and engineering occupations; SSO = social sciences occupation; PO = production occupation; A = rank difference between AEO and SSO ≤ 2 ; B = rank difference between SSO and PO ≤ 2 ; C = rank difference between AEO and PO ≤ 2 ; W = included in the top 10 skills in the World Economic Forum (2016) report; F = included in the 14 new foundational skills in the Burning Glass Technologies and Business-Higher Education Forum (2019) report.

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Mixed
Evidence

RQ1*b*: Common Meaning

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Soft-Skill Training (e.g., organizational, interpersonal, teamwork, communication skills)	Employment and monthly wages over the longer term	(Barrera-Osorio, Kugler, and Silliman, 2020)

Standardized Assessment

Standardized Assessment

Employer Assessment

Standardized Assessment

Employer Assessment



Assessment & Evaluation in Higher Education



ISSN: 0260-2938 (Print) 1469-297X (Online) journal homepage: <https://www.tandfonline.com/loi/caeh20>

Assessing critical thinking in higher education: the HEIghten™ approach and preliminary validity evidence

Ou Lydia Liu, Liyang Mao, Lois Frankel & Jun Xu

To cite this article: Ou Lydia Liu, Liyang Mao, Lois Frankel & Jun Xu (2016) Assessing critical thinking in higher education: the HEIghten™ approach and preliminary validity evidence, Assessment & Evaluation in Higher Education, 41:5, 677-694, DOI:

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Employer Assessment

CRITICAL THINKING SKILLS

1 Knowledge	define fill in the blank list identify	label locate match memorize	name recall spell	state tell underline
	Who _____? What _____? Where _____? When _____?		How _____? Describe _____? What is _____?	
2 Comprehension	convert describe explain	interpret paraphrase put in order	restate retell in your own words rewrite	summarize trace translate
	Re-tell _____ in your own words. What is the main idea of _____?		What differences exist between _____? Can you write a brief outline?	
3 Application	apply compute conclude construct	demonstrate determine draw find out	give an example illustrate make operate	show solve state a rule or principle use
	How is _____ an example of _____? How is _____ related to _____? Why is _____ significant?		Do you know of another instance where _____? Could this have happened in _____?	
4 Analysis	analyze categorize classify compare	contrast debate deduct determine the factors	diagram differentiate dissect distinguish	examine infer specify
	Separating a whole into component parts What are the parts or features of _____? Classify _____ according to _____. Outline/diagram/web/map _____.		How does _____ compare/contrast with _____? What evidence can you present for _____?	
5 Synthesis	change combine compose construct create design	find an unusual way formulate generate invent originate plan	predict pretend produce rearrange reconstruct reorganize	revise suggest suppose visualize write
	Combining ideas to form a new whole What would you predict/infer from _____? What ideas can you add to _____? How would you create/design a new _____?		What solutions would you suggest for _____? What might happen if you combined _____ with _____?	
6 Evaluation	appraise choose compare conclude	decide defend evaluate give your opinion	judge justify prioritize rank	rate select support value
	Developing opinions, judgements, or decisions Do you agree that _____? Explain. What do you think about _____? What is most important?		Prioritize _____ according to _____? How would you decide about _____? What criteria would you use to assess _____?	

Standardized Assessment

Employer Assessment



Assessment & Evaluation in Higher Education



ISSN: 0260-2938 (Print) 1469-297X (Online) Journal homepage: <https://www.tandfonline.com/loi/caeh20>

Assessing **critical thinking** in higher education: the HEIghten™ approach and preliminary validity evidence

Ou Lydia Liu, Liyang Mao, Lois Frankel & Jun Xu

To cite this article: Ou Lydia Liu, Liyang Mao, Lois Frankel & Jun Xu (2016) Assessing critical thinking in higher education: the HEIghten™ approach and preliminary validity evidence, Assessment & Evaluation in Higher Education, 41:5, 677-694, DOI:

CRITICAL THINKING SKILLS

1 Knowledge	define fill in the blank list identify	label locate match memorize	name recall spell	state tell underline
Identification and recall of information	Who _____? What _____? Where _____? When _____?		How _____? Describe _____? What is _____?	
2 Comprehension	convert describe explain	interpret paraphrase put in order	restate retell in your own words rewrite	summarize trace translate
Organization and selection of facts and ideas	Re-tell _____ in your own words. What is the main idea of _____?		What differences exist between _____? Can you write a brief outline?	
3 Application	apply compute conclude construct	demonstrate determine draw find out	give an example illustrate make operate	show solve state a rule or principle use
Use of facts, rules, and principles	How is _____ an example of _____? How is _____ related to _____? Why is _____ significant?		Do you know of another instance where _____? Could this have happened in _____?	
4 Analysis	analyze categorize classify compare	contrast debate deduct determine the factors	diagram differentiate dissect distinguish	examine inter- specify
Separating a whole into component parts	What are the parts or features of _____? Classify _____ according to _____. Outline/diagram/web/map _____.		How does _____ compare/contrast with _____? What evidence can you present for _____?	
5 Synthesis	change combine compose construct create design	find an unusual way formulate generate invent originate plan	predict pretend produce rearrange reconstruct reorganize	revise suggest suppose visualize write
Combining ideas to form a new whole	What would you predict/infer from _____? What ideas can you add to _____? How would you create/design a new _____?		What solutions would you suggest for _____? What might happen if you combined _____ with _____?	
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**RQ2: Is there movement
towards a common
framework?**

**RQ2: Is there movement
towards a common
framework?**

**Yes, but it's
complicated**

RQ2: Unifying Frameworks



Listening. Learning. Leading.®

Research Report
ETS RR-13-22

**Synthesizing Frameworks of Higher
Education Student Learning Outcomes**

RQ2: Unifying Frameworks



Listening. Learning

Table 1

Frameworks of Learning Outcomes

Framework	Abbreviated title	Author/impetus
Framework for Higher Education Qualifications	QAA-FHEQ	Quality Assurance Agency for Higher Education
European Higher Education Area Competencies	Bologna	European Commission: European Higher Education Area
Liberal Education and America's Promise	LEAP	Association of American Colleges and Universities
Frameworks for Learning and Development Outcomes	CAS	The Council for the Advancement of Standards in Higher Education
The Degree Qualifications Profile	DQP	The Lumina Foundation
The Assessment & Teaching of 21st Century Skills	ATC21S	Collaboration among Cisco, Intel, Microsoft, the University of Melbourne, and others
ETA Competency Model Clearinghouse's General Competency Model Framework	USDOL-ETA	U.S. Department of Labor, Employment and Training Administration

Research Report
ETS RR-13-22

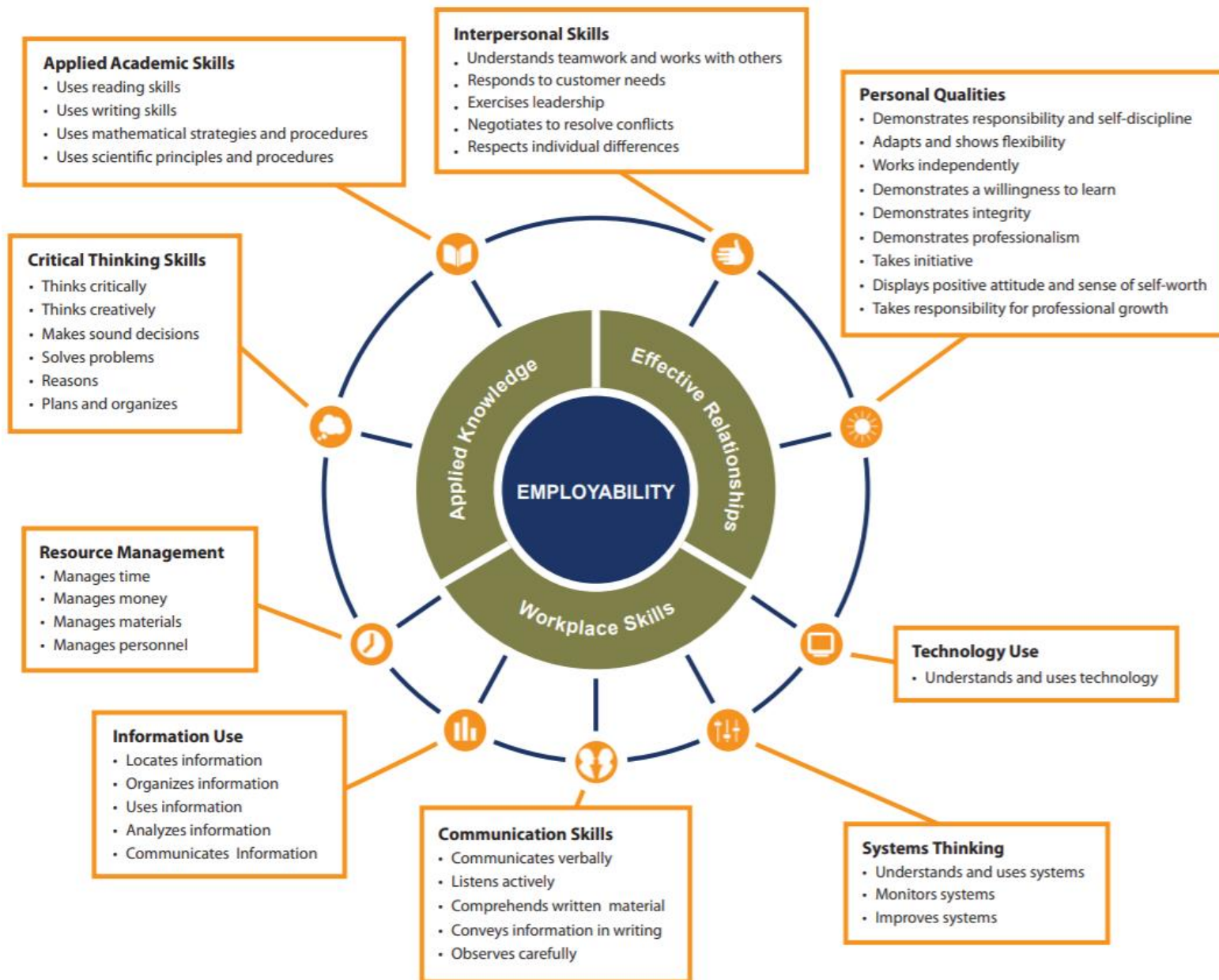
Synthesizing Frameworks of Higher Education Student Learning Outcomes

RQ2: Unifying Frameworks

Table 2

A Summary of the Seven Critical Domains and Use in Educational Testing Service (ETS) Products and Assessments

Domain	Components	Domain measured in ETS products				
		EPP	Criterion	TOEFL/ TOEIC ^a	iSkills	PPI ^b
Creativity	The generation of new ideas					
	Novel integration of existing ideas					
	Application of new ideas in a real-world setting					X
Critical thinking	Thinking critically					
	Solving problems	X				
	Synthesize information					
Teamwork	Sense-making					
	Fulfill roles within a team					
	Treat group members with respect					X
Effective communication	Motivate group members					
	Effectively communicate multiple types of messages					
	Communicate across multiple forms	X	X	X		X
Digital & information literacy	Effectively deliver messages to varying audiences					
	Accessing and finding information					
	Analyzing and evaluating information				X	
Citizenship	Using and managing information					
	Applying technology effectively					
	Civic knowledge					
Life skills	Participating in civic processes					
	Action and organization toward change					
	Respect for others					
Life skills	Ethics and integrity					
	Independence, self-directed learning					
	Time management					X
Life skills	Goal setting					
	Adaptation, flexibility					



APPLIED KNOWLEDGE

Applied
Academic Skills**Reading skills**

Students apply/demonstrate reading skills by interpreting written instructions/project directions and constructing responses, using print and online materials as resources, completing worksheets, and seeking clarification about what they have read.

Writing skills

Students rely on writing skills to construct lab reports, posters, and presentation materials, take notes, and compose responses to essay questions.

Math strategies/procedures

Students use computational skills appropriately and make logical choices when analyzing and differentiating among available procedures. Outside of math class, this includes creating/interpreting tables and graphs and organizing/displaying data.

Scientific principles/procedures

Students follow procedures, experiment, infer, hypothesize (even as simple as "what if we do it this way"), and construct processes to complete a task (can occur outside of math/science classes).

Critical
Thinking Skills**Thinks creatively**

Students create innovative and novel ideas/solutions and display divergent thinking. This can be seen in oral presentations and creative writing assignments, open-ended tasks, and project design.

Thinks critically

Students display analytical and strategic thinking. This can be seen in debating an issue, converging on an understanding, assessing a problem, and questioning (playing devil's advocate).

The QA Commons: Essential Employability Qualities

- (1) Communication
- (2) Problem-solving
- (3) Creativity and Diligence
- (4) Collaborations
- (5) Adaptability
- (5) Ethical Decision-makers
- (7) Professional/Self-regulatory
- (8) Continuous learning

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- (8) Continuous learning



The QA Commons utilizes five criteria that represent a comprehensive and integrated framework for employability.



1

EEQ Graduate Preparation

Accreditors require all programs to define and assess student learning outcomes (SLOs). However, institutions rarely integrate essential qualities employers cite as most needed into their assessment frameworks. The EEQs are evidence-based and define employability skills and qualities, situated in workplace contexts, that can be incorporated into program and course learning outcomes. The EEQ CERT validates that all students have gained proficiency in employability skills.

2

Career Support Services

Today's students need career information and guidance more than ever. According to a Gallup study, only 17% of those students who used career services found them helpful. The QA Commons leads the effort to transform career services by endorsing programs' integrating career services throughout the program and tracking the results.

3

Employer Engagement

Employer engagement is vital to ensuring career readiness. While employer advisory boards are important for occasional advice, they are rarely sufficient. Employers seek deeper engagement that is substantive, relevant, and utilized.

4

Student & Alumni Engagement

Incorporation of alumni engagement and program feedback is essential. Similarly, student involvement and self assessment are needed to provide confidence they are prepared for the workplace.

5

Public Information

Program-specific information on completion rates, average loans, graduate careers, and salaries published in public forums empowers and informs students and parents about career pathways and opportunities.

The QA Commons: Pilot Study

- 14 institutions
- 27 different degree programs
- Community colleges
- Four-year schools
- Aims:
 - (a) Work with stakeholders to transform programs of study to incorporate, measure, and assess key 21st century skills at both the program and course levels;
 - (b) Identify promising practices institutions can incorporate which are informed by employers' input; and
 - (c) Develop avenues to communicate the skills learned by students to employers.



The QA Commons utilizes five criteria that represent a comprehensive and integrated framework for employability.



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Other Notable Frameworks: Are They Antithetical?



Change: The Magazine of Higher Learning

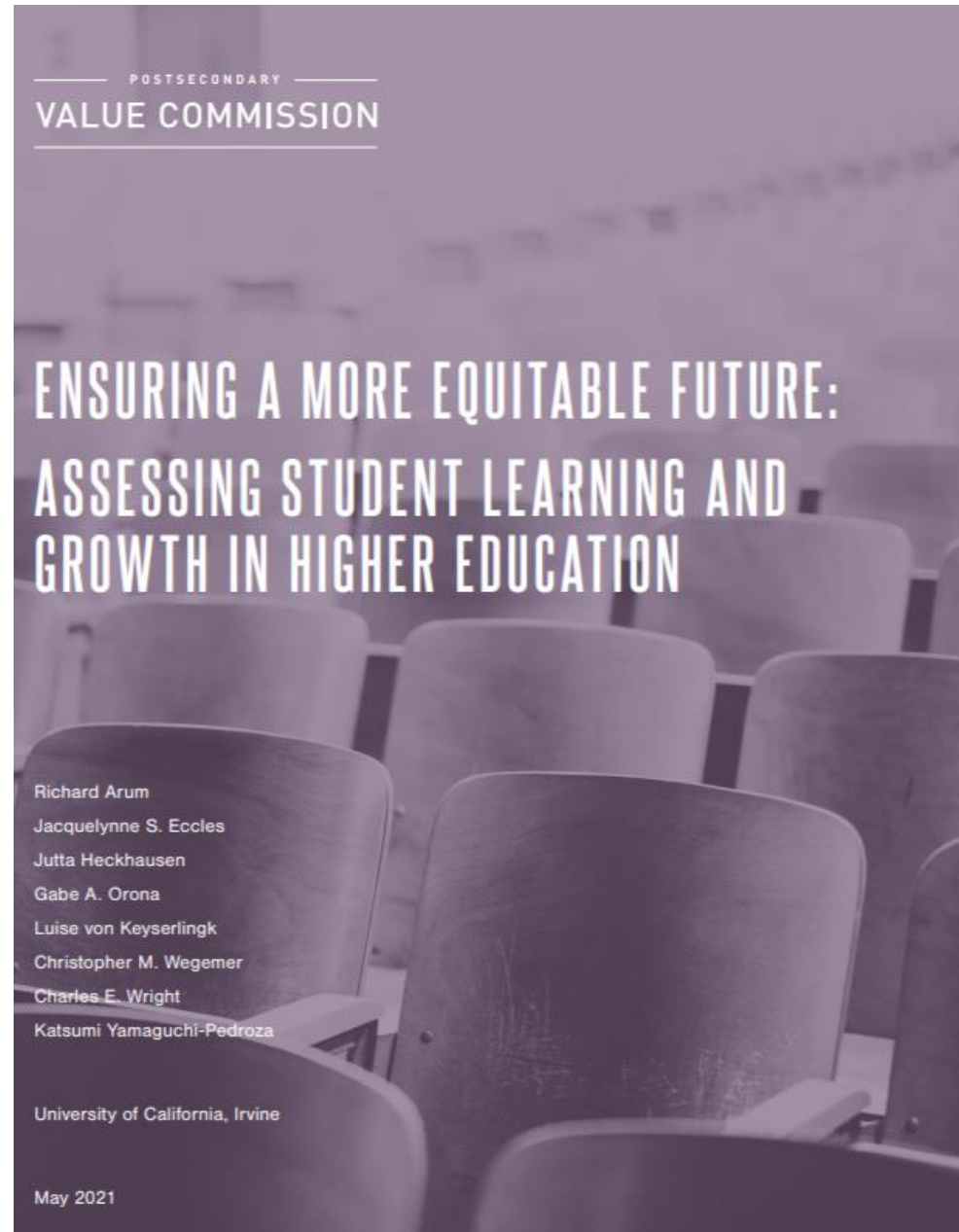
 Routledge
Taylor & Francis Group

ISSN: 0009-1383 (Print) 1939-9146 (Online) Journal homepage: <https://www.tandfonline.com/loi/vchn20>

Re-thinking Soft Skills and Student Employability: A New Paradigm for Undergraduate Education

Matthew T. Hora, Ross I. Benbow & Bailey R. Smolarek

Other Notable Frameworks: Are They Antithetical?



Other Notable Frameworks: Are They Antithetical?

Figure 1: Measuring Postsecondary Value



Moving Beyond Frameworks: *Work Colleges*



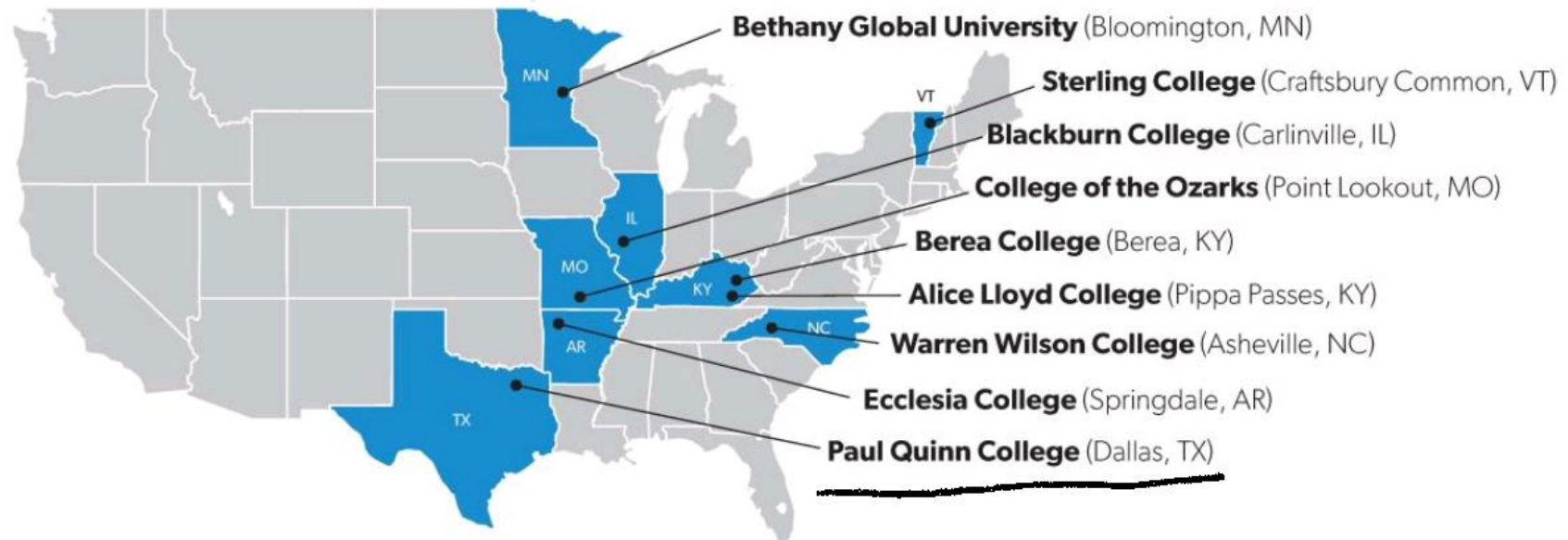
Earning to Learn: How America's Work Colleges Are Bridging Equity Gaps and Connecting Education to Employment

By Jocelyn Pickford

March 2018

Moving Beyond Frameworks: *Work Colleges*

Figure 1. Work Colleges Across America



Funders Recap

Funder Recap

- RQ1: Funders could provide and direct resources in the following ways:
 - Fund more research predicting work-based metrics via academic developed or standardized test instruments.
 - Additionally, a more direct means of establishing confidence in the *meaning* of terms used is to study the convergence between standardized assessments measuring 21st century skills and employer ratings of the same employees on the same constructs.

Funder Recap

- RQ2a: Funders could provide and direct resources in the following ways:
 - Fund research aimed at comparing students who have graduated from participating programs against those that haven't in skill growth and labor market outcomes
 - Provide incentives for more institutions and programs to participate in the EEQ initiative
 - Provide incentives for employers to consider EEQ's in the hiring of job candidates

Funder Recap

- RQ2b: Funders could provide and direct resources in the following ways:
 - Fund research aimed at comparing the students who have graduated from work colleges against those that haven't in skill growth and labor market outcomes
 - Incentivize work colleges to collect and report skill growth data across programs of study

Next Steps: Proposals for the future

Proposals for the Future



Theories of Skill Development

Proposals for the Future



Theories of Skill Development



Pedagogy

Proposals for the Future



Theories of Skill Development



Pedagogy



Measurement

Theories of Skill Development

- There is virtually no work that connects and synthesizes theories of skill development and university education in a manner that makes precise predictions

Theories of Skill Development

- There is virtually no work that connects and synthesizes theories of skill development and university education in a manner that makes precise predictions
- That is, there is no unified theory for how 21st century skills develop (Care & Kim, 2018).

UCI Theories of Skill Development

INTELLIGENCE 22, 227-257 (1996)

A Theory of Adult Intellectual Development: Process, Personality, Interests, and Knowledge

PHILLIP L. ACKERMAN
University of Minnesota

238

ACKERMAN

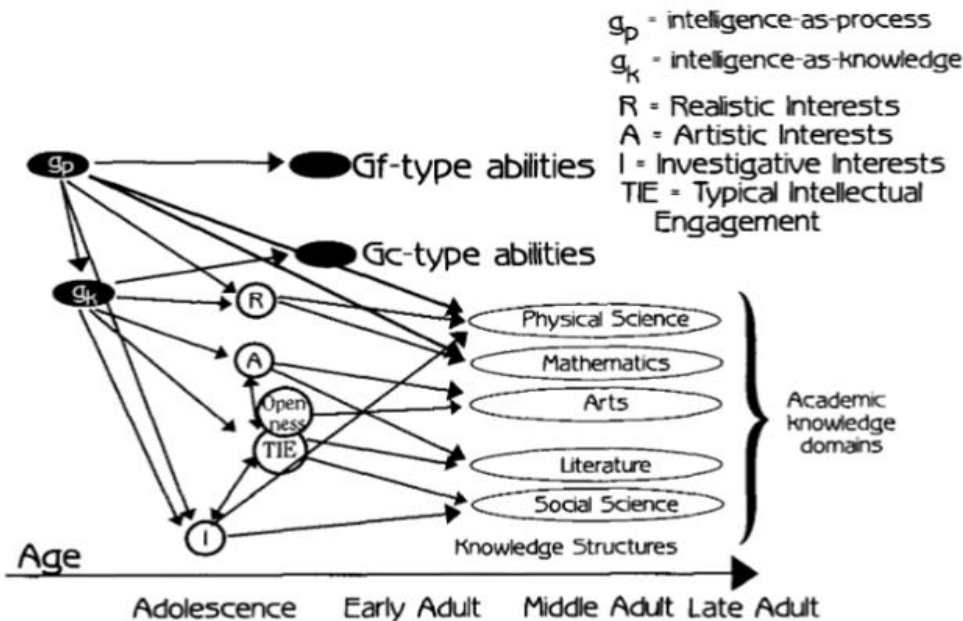


Figure 3. Illustration of the PPIK theory, outlining the influences of intelligence-as-process, personality, interests, and intelligence-as-knowledge during adult development, covering academic and occupational knowledge. Arrows represent correlational influence (supported by significant correlations from the data collected by Rolfhus & Ackerman, 1996).

- Ackerman's Theory of Adult Intellect (1996) could provide insights into how personality (noncognitive) and cognitive abilities interact to develop domain-specific knowledge and expertise

Theories of Skill Development

Psychological Review

VOLUME 87 NUMBER 6 NOVEMBER 1980

A Theory of Cognitive Development: The Control and Construction of Hierarchies of Skills

Kurt W. Fischer
University of Denver

A theory of cognitive development, called skill theory, attempts to provide tools for the prediction of developmental sequences and synchronies in any domain at any point in development by integrating behavioral and cognitive-developmental concepts. Cognitive development is explained by a series of skill

- Fischer's Theory of Skill Development (1980) could provide insights into how skills develop within skill domains, and how to predict sequential structures.

Table 3
Sensory-Motor and Representational Levels of Skills

Level	Name of structure	Sensory-motor sets ^a	Representational sets	Abstract sets ^b
1	Single sensory-motor set	[¹ A] or [¹ B]		
2	Sensory-motor mapping	[² A — ² B]		
3	Sensory-motor system	[³ A _{G,H} ↔ ³ B _{G,H}]		
4	System of sensory-motor systems, which is a single representational set	$\begin{bmatrix} {}^4A^R & \leftrightarrow & {}^4B^R \\ \updownarrow & & \updownarrow \\ {}^4C^R & \leftrightarrow & {}^4D^R \end{bmatrix} = [{}^4R]$		
5	Representational mapping		[⁵ R — ⁵ T]	
6	Representational system		[⁶ R _{J,K} ↔ ⁶ T _{J,K}]	
7	System of representational systems, which is a single abstract set		$\begin{bmatrix} {}^7R^R & \leftrightarrow & {}^7T^R \\ \updownarrow & & \updownarrow \\ {}^7V^R & \leftrightarrow & {}^7X^R \end{bmatrix} \equiv [{}^7R]$	

^a Sensory-motor sets continue after Level 4, but the formulas become so complex that they have been omitted. To fill them in, simply replace each representational set with the sensory-motor formula for Level 4.

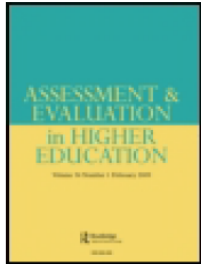
^b Development through the abstract tier shows the same cycle as development through the sensory-motor and representational tiers. Abstractions are built from representational and sensory-motor sets in the same way that representations are built from sensory-motor sets.

Pedagogy

- In the frameworks reviewed, how an emphasis on 21st century skills at the mission statement or policy level influences actual teaching practices are unclear.
- What's more, some of the frameworks propose merely recording if instructors include some 21st century skills as outcomes on their syllabi or teaching plans

Pedagogy

- In the frameworks reviewed, how an emphasis on 21st century skills at the mission statement or policy level influences actual teaching practices are unclear.
- Hora, et al (2018), *“Asking an untrained and unsupported adjunct instructor to magically transform a 300-student lecture hall into a group of highly capable, critically thinking engineers is, to put it mildly, unreasonable.”*



Assessment & Evaluation in Higher Education

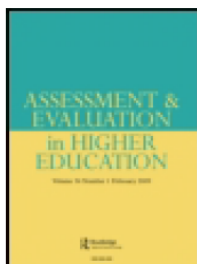


ISSN: (Print) (Online) Journal homepage: <https://www.tandfonline.com/loi/caeh20>

Inculcating curiosity: pilot results of an online module to enhance undergraduate intellectual virtue

Gabe Avakian Orona & Duncan Pritchard

To cite this article: Gabe Avakian Orona & Duncan Pritchard (2021): Inculcating curiosity: pilot results of an online module to enhance undergraduate intellectual virtue, Assessment & Evaluation in Higher Education, DOI: [10.1080/02602938.2021.1919988](https://doi.org/10.1080/02602938.2021.1919988)



Assessment & Evaluation in Higher Education

ISSN: (Print) (Online) Journal homepage: <https://www.tandfonline.com/doi/full/10.1080/02602938.2021.1911111>

Inculcating curiosity: pilot module to enhance undergraduate intellectual virtue

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Table A. IVC applications of pedagogical interventions to develop interest

Type of Interest	Pedagogical Intervention (and sources)	IVC Application
Triggering situational interest	<i>Novel experiences</i> (Palmer, 2009; Maltese & Harsh, 2015; Quinlan, 2019)	Introductory segment that capitalizes on the novelty of the concept of intellectual virtue to students; offers its relevance throughout history as well as for the students' personal educational journey.
	<i>Being exposed to scientists' struggles and applications of concepts</i> (Hong & Lin-Siegler, 2012)	Videos of academics from a range of disciplines describing how a particular intellectual virtue is relevant to their work (e.g., we supply a video from a prominent bioroboticist, filmed in his laboratory, discussing how the intellectual virtue of curiosity is central to his work and necessary to doing quality research).
	<i>Interactive learning activities alongside a lecture course</i> (Yuretich et al., 2001)	Recordings of group activities of fellow university students. The recordings displayed collaborative problem-solving discussions that students were encouraged participate in alongside the video.
Maintaining situational interest	<i>Repeated involvement (inquiry activities) and novelty (discrepant events)</i> (Palmer, 2004)	Structured engaging quizzes followed each video. Quizzes were designed such that the process of solving the question(s) reflected intellectual virtue (curiosity) and its relevance to educational problem-solving.
	<i>Writing activities linking personal goals and values to class content</i> (Hulleman & Harackiewicz, 2009;)	Practical exercises for students to do to reflect on their own development of intellectual virtue, such as recommendations for reading and approaches to educational inquiry.

Note. The table is a modified version of a summary table presented in van der Hoeven Kraft (2017). The types of interest correspond to Hidi & Renniger (2006) phases of interest. In their model, a third phase--supporting individual interest--is presented as the final stage. While research has also applied pedagogical interventions to develop this phase of interest, the one-quarter long, pilot IVC module presented here focuses on the first two phases: triggering situational interest and maintaining situational interest. IVC = Intellectual Virtue Curriculum.

Pedagogy

Closing the middle-skills gap widened by digitalization: how technical universities can contribute through Challenge-Based Learning

Ruggero Colombari  and Paolo Neirotti 

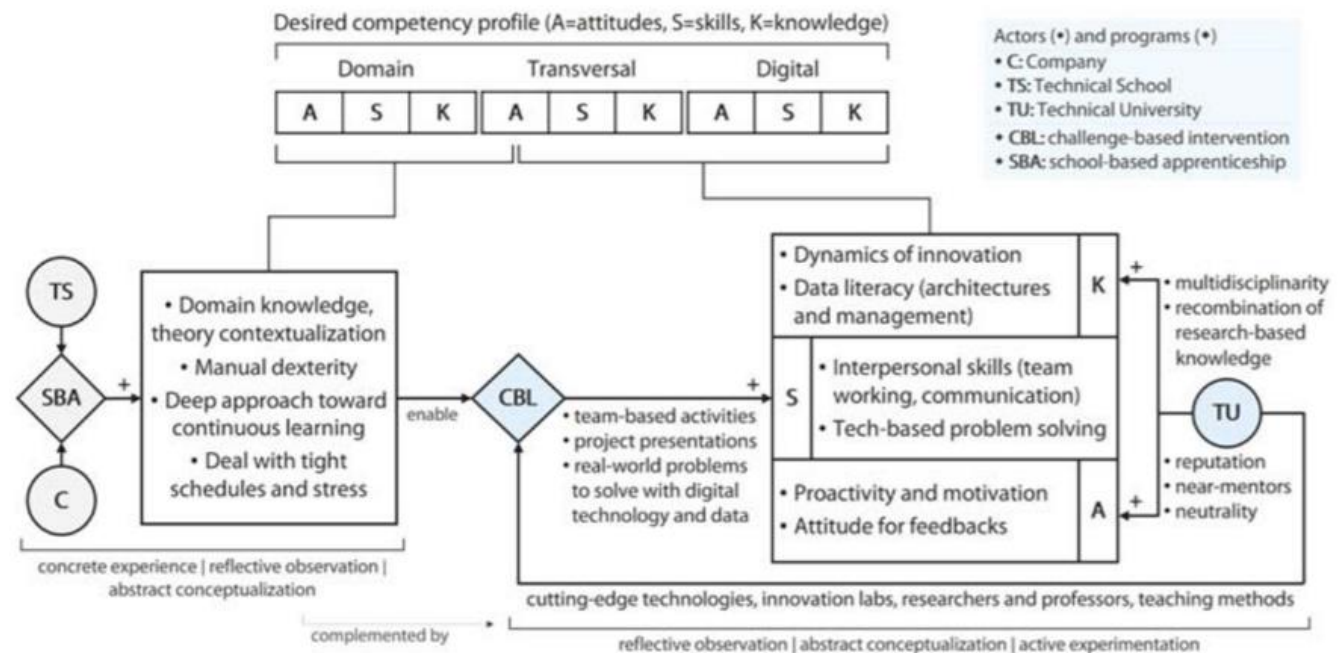
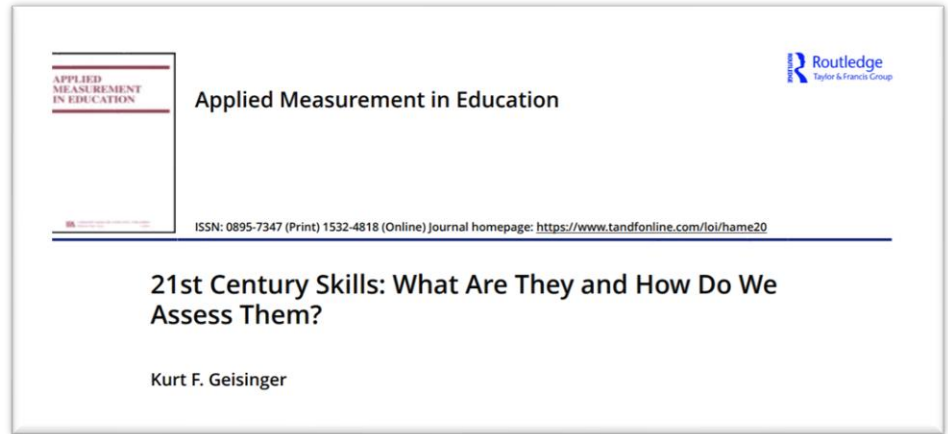


Figure 3. The challenge-based intervention: complementarity with on-the-job training and the role of the university.

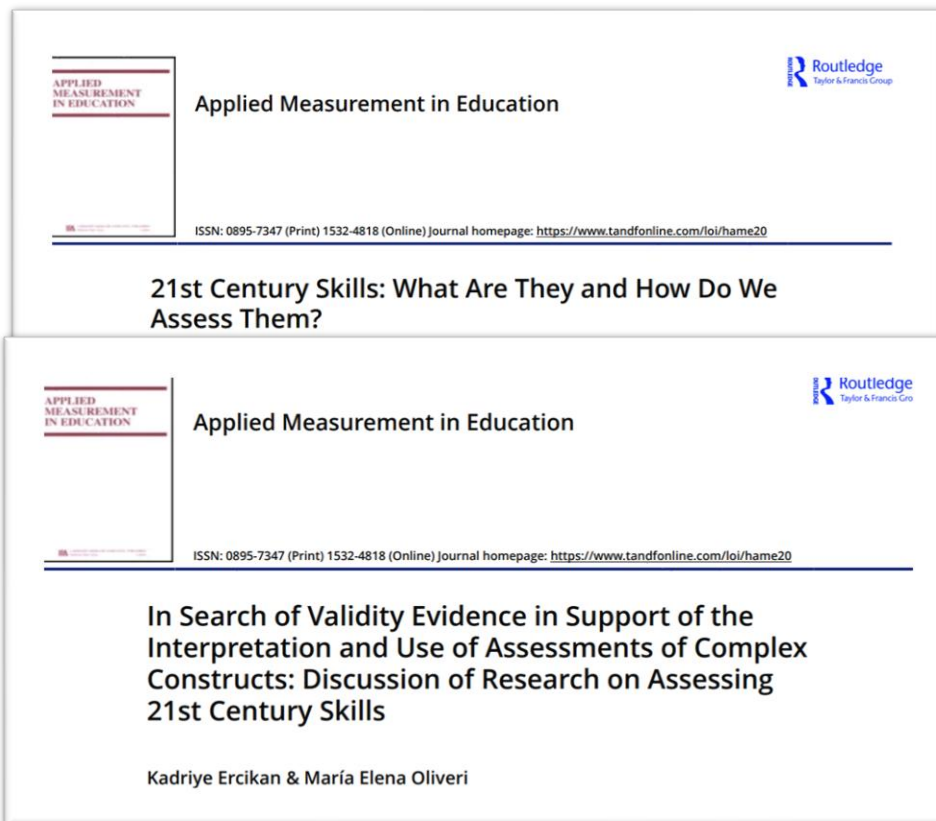
Measurement

- Sound measurement precludes any claims of skill development in higher education.
- Measurement theory should be thoughtfully considered in the construction of 21st century skill assessments.



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Applied Measurement in Education

ISSN: 0895-7347 (Print) 1532-4818 (Online) Journal homepage: <https://www.tandfonline.com/loi/hame20>

21st Century Skills: What Are They and How Do We Assess Them?

Applied Measurement in Education

ISSN: 0895-7347 (Print) 1532-4818 (Online) Journal homepage: <https://www.tandfonline.com/loi/hame20>

In Search of Validity Evidence in Support of the Interpretation and Use of Assessments of Complex Constructs: Discussion of Research on Assessing 21st Century Skills

ASSESSMENT & EVALUATION IN HIGHER EDUCATION
2019, VOL. 44, NO. 3, 321-337
<https://doi.org/10.1080/02602938.2018.1504277>

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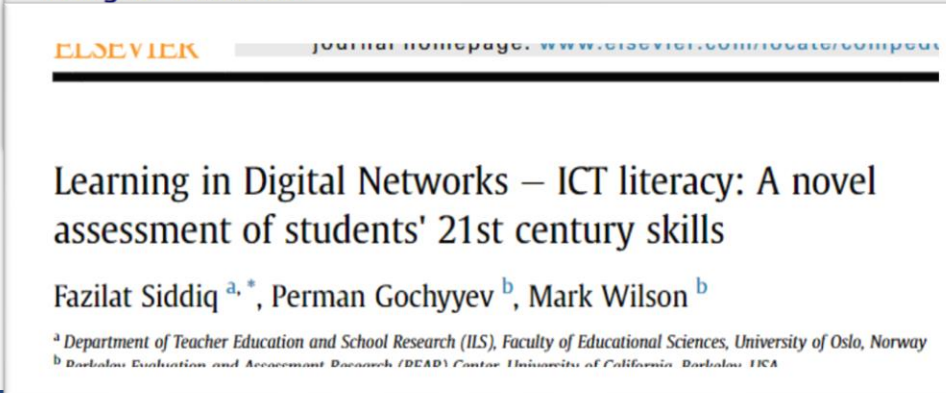
Reviewing affective, behavioural and cognitive learning gains in higher education

Jekaterina Rogaten^a , Bart Rienties^a , Rhona Sharpe^b, Simon Cross^a, Denise Whitelock^a, Simon Lygo-Baker^b and Allison Littlejohn^a

^aOpen University, United Kingdom; ^bUniversity of Surrey, United Kingdom

Measurement

- Sound measurement precludes any claims of skill development in higher education.
- Measurement theory should be thoughtfully considered in the construction of 21st century skill assessments.



Thank you!

BILL & MELINDA
GATES *foundation*



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