# Modernizing Learning


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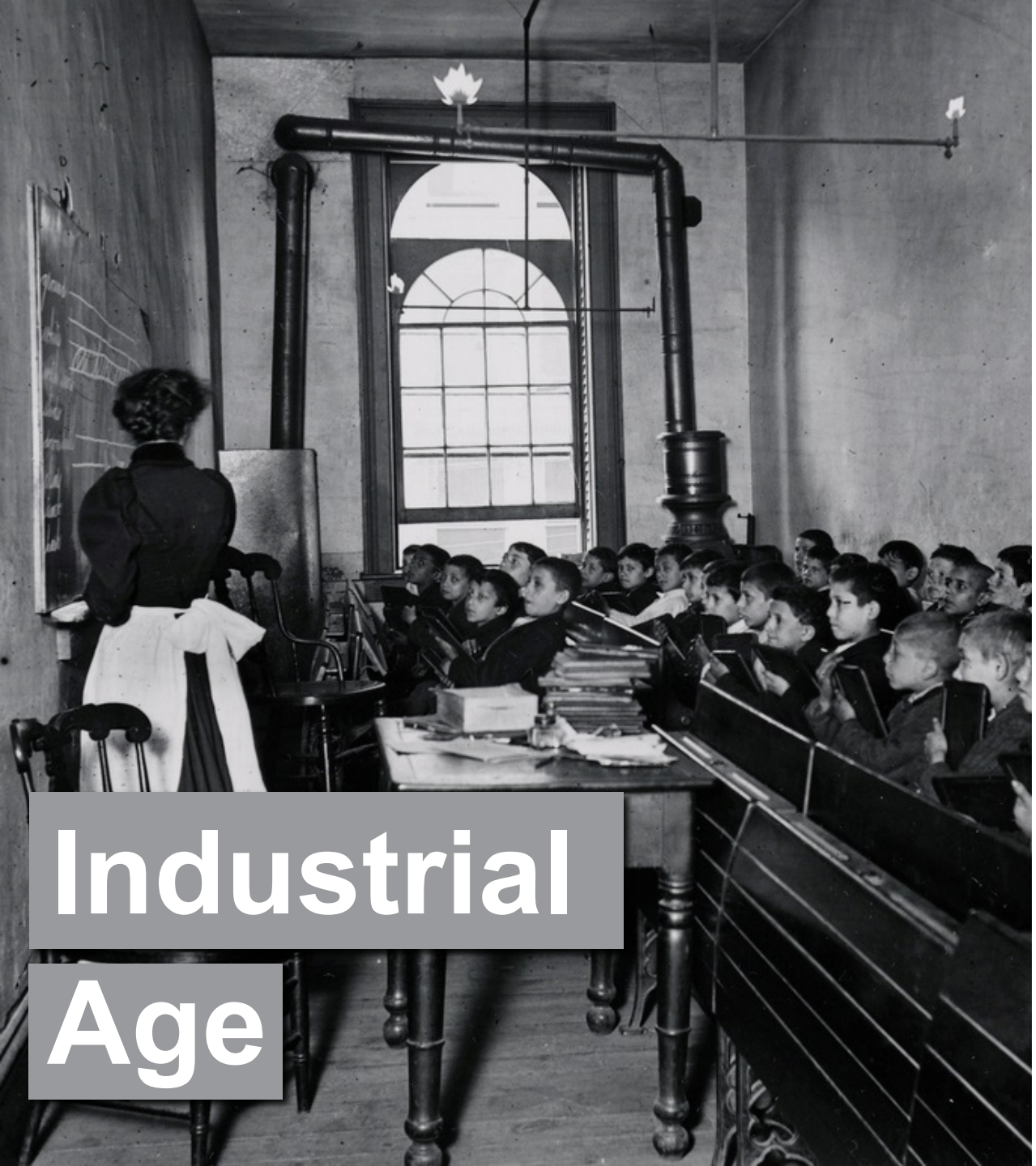
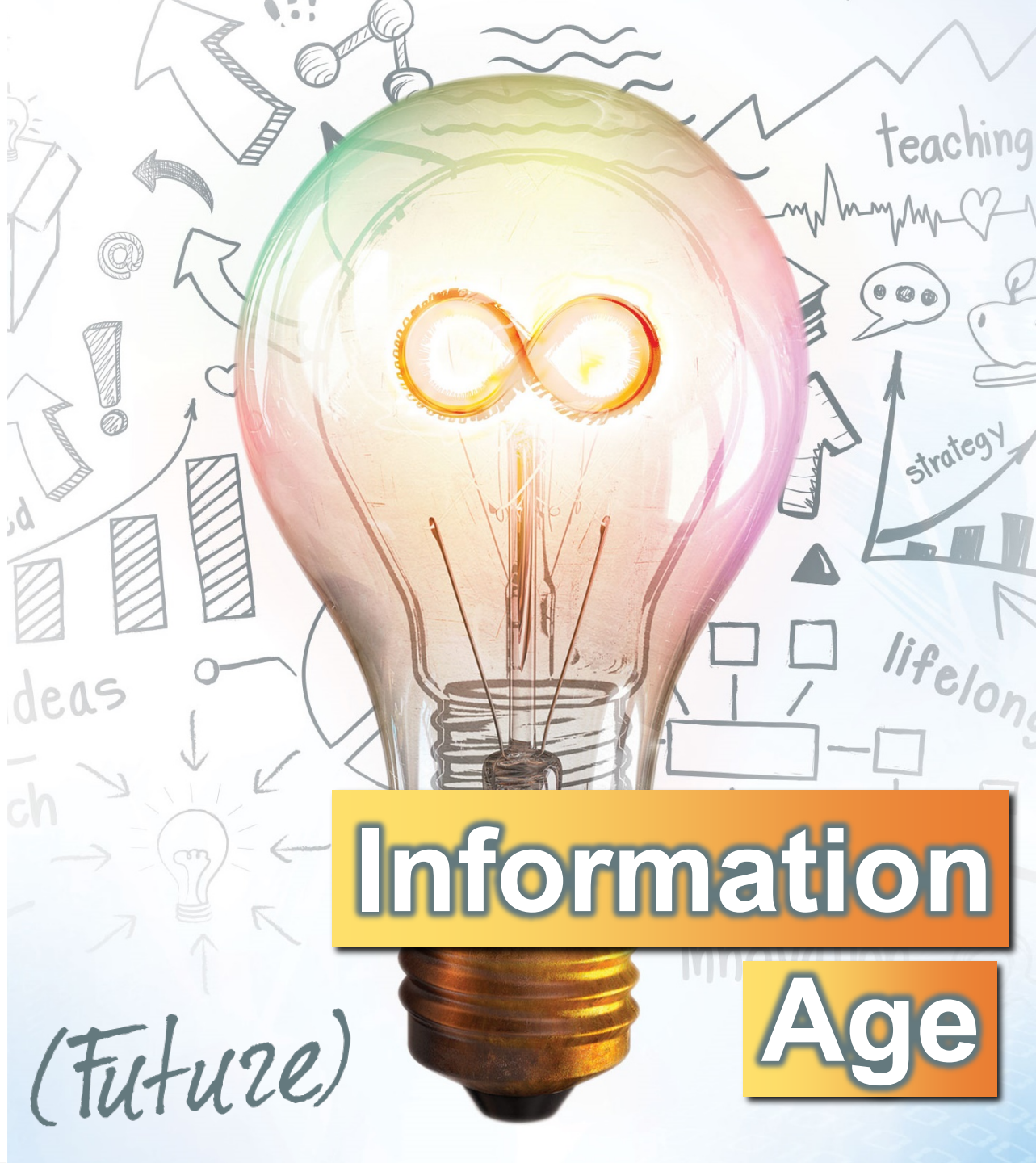
19 June 2019



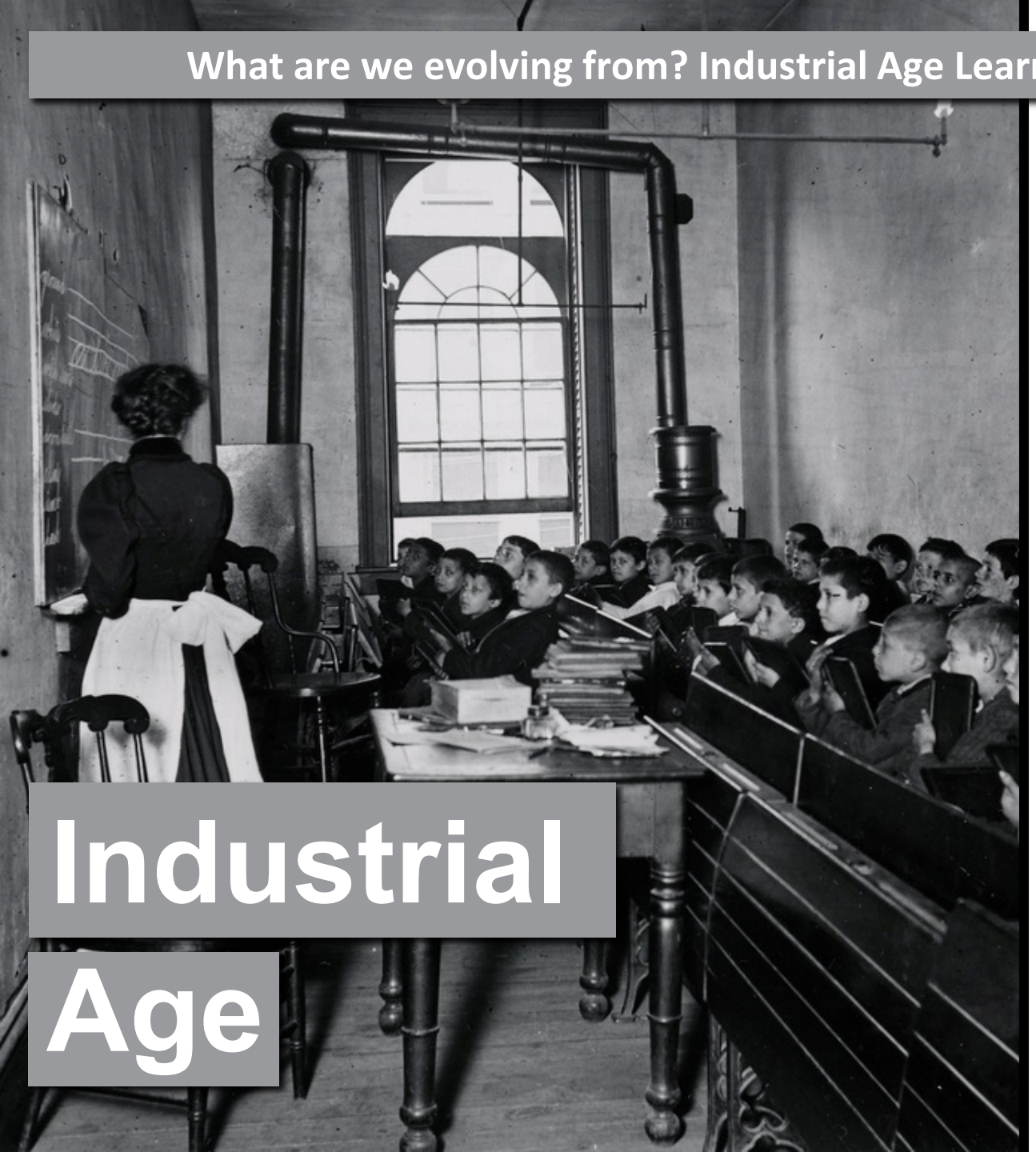
# Industrial Age




# Information Age

(Future)

## What are we evolving from? Industrial Age Learning

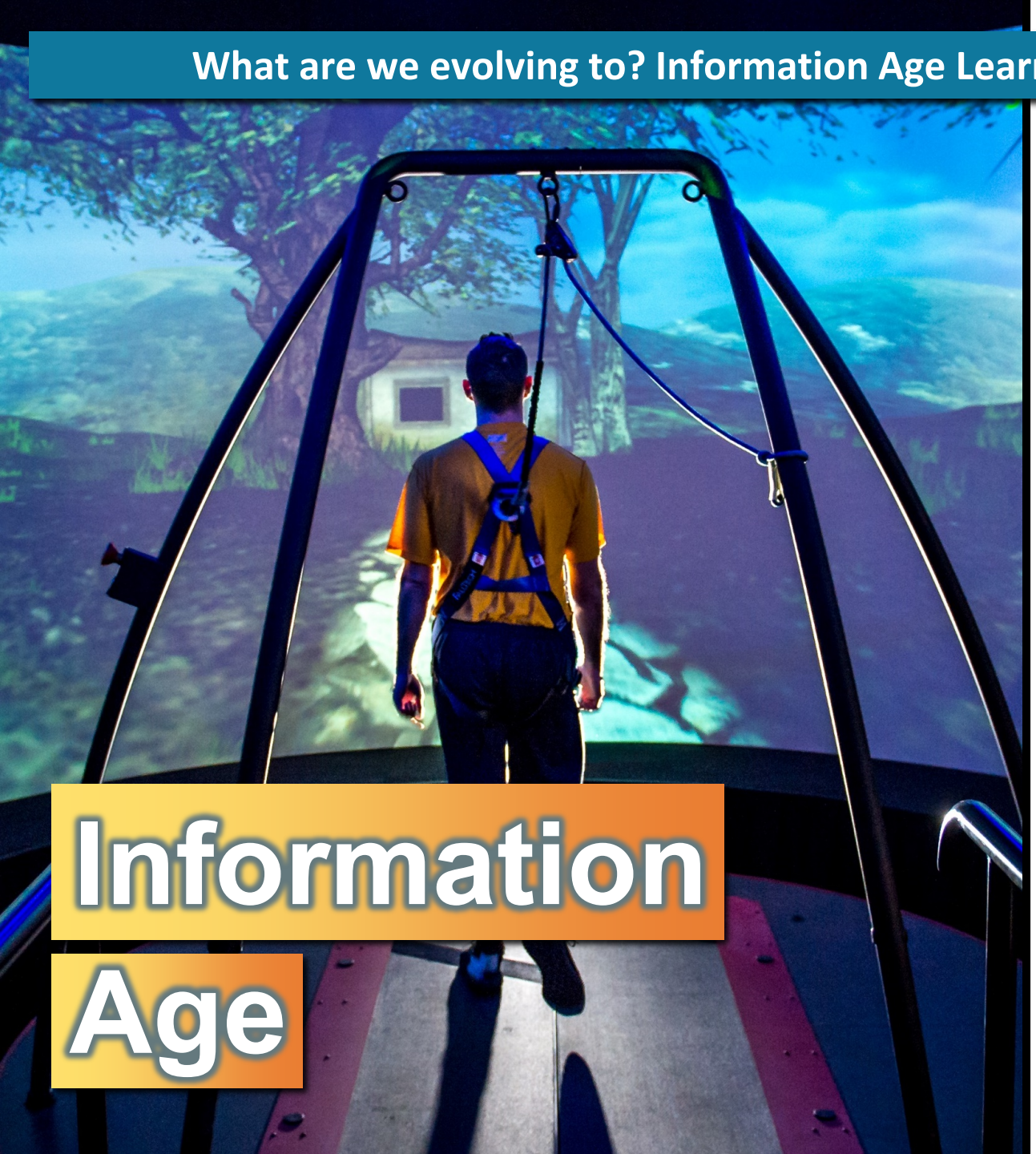


# Industrial Age

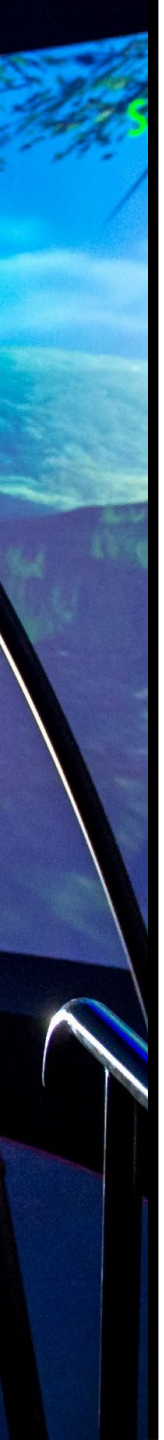
- Time-based and episodic
- Assembly line–like
- One-size-fits-all
- Input-focused
- Passive
- Focused on transferring facts and psychomotor skills from experts to students

Warning: This is intentionally hyperbolic and a bit apocryphal, but you get the idea…

# What are we evolving to? Information Age Learning




- Lifelong continuum
- Interconnected
- Personalized
- Outcome-focused
- Active
- Focused on fostering 21st century competencies



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# Future Learning Ecosystem

Why?


**The Military Services and other Federal Agencies are already exploring the Future Learning Ecosystem concept**

# At the Tipping Point: Learning Science and Technology as Key Strategic Enablers for the Future of Defense and Security

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## ABSTRACT

According to former U.S. Secretary of Defense, Ash Carter, today's national security environment is "dramatically different—and more diverse and complex in the scope of its challenges—than the one we've been engaged with for the last 25 years, and it *requires new ways of thinking and new ways of acting*" (2016, emphasis is ours). These new ways cannot be achieved without significant changes to lifelong (or at least career-long) personnel development. This paper focuses on one aspect of that (r)evolution, i.e., specifically examining the challenges, goals, projects, and recommended actions related to the transformation of training and education in the defense and security sectors.

For more than a decade, training and education professionals have beaten this drum. Researchers and dedicated practitioners have pursued tactical-level programs in cognitive readiness, improved decision-making, adaptability, accelerated learning, instructional excellence, and so on. Small "inkblots" of excellence formed, and many papers were written. These inkblots are now converging, and grassroots efforts are being strengthened by serious top-level patronage and policy direction. Now, strategic-level organizational change seems possible.

All of the U.S. military services, as well as many other security agencies and coalition partners, have released detailed guidance on how to evolve their learning and development processes. This paper summarizes these complementary efforts and then recommends collective actions that may yield meaningful returns in the short- to mid-term. Specifically, these recommendations focus on instructional quality, competencies, credentials, data analytics, data interoperability, personalization, learning on demand, integrated human–machine systems, a technology-enabled continuum of learning providing multiple paths for achievement, and an enterprise approach to talent management.

## ABOUT THE AUTHORS

**Elaine M. Raybourn, Ph.D.** is a Principal Member of the Technical Staff in Cognitive Science & Systems at Sandia National Laboratories, and an ERCIM (European Research Consortium for Informatics and Mathematics) Fellow who has worked as a guest scientist in premier research laboratories in Germany, England, and France.

**Sae Schatz, Ph.D.** serves as the Director of the Advanced Distributed Learning (ADL) Initiative, a research and

resilience, and human performance



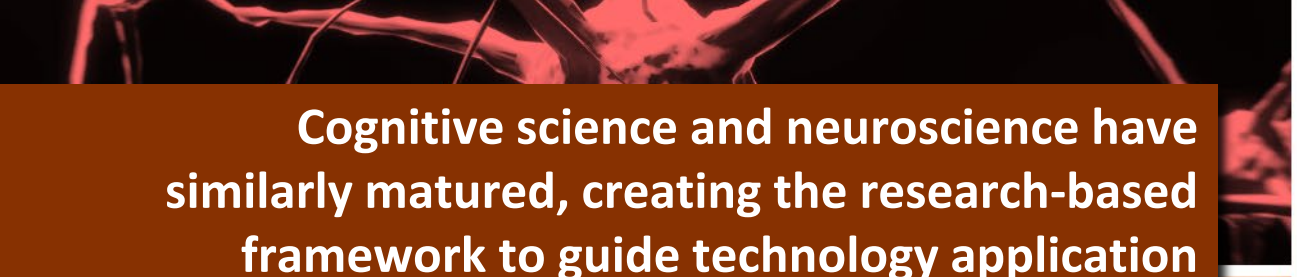
**This paper summarizes many of the top-level strategy and policy documents directing an evolution in military learning and development systems**

At the Tipping Point: Learning Science and Technology as Key Strategic Enablers for the Future of Defense and Security

Raybourn et al. (2017) I/ITSEC

# Technology, including artificial intelligence and data science, have progressed—making the future learning ecosystem technically viable


**Cognitive science and neuroscience have similarly matured, creating the research-based framework to guide technology application**





…and there are other drivers encouraging the modernization of our talent development systems



# SAMR Model

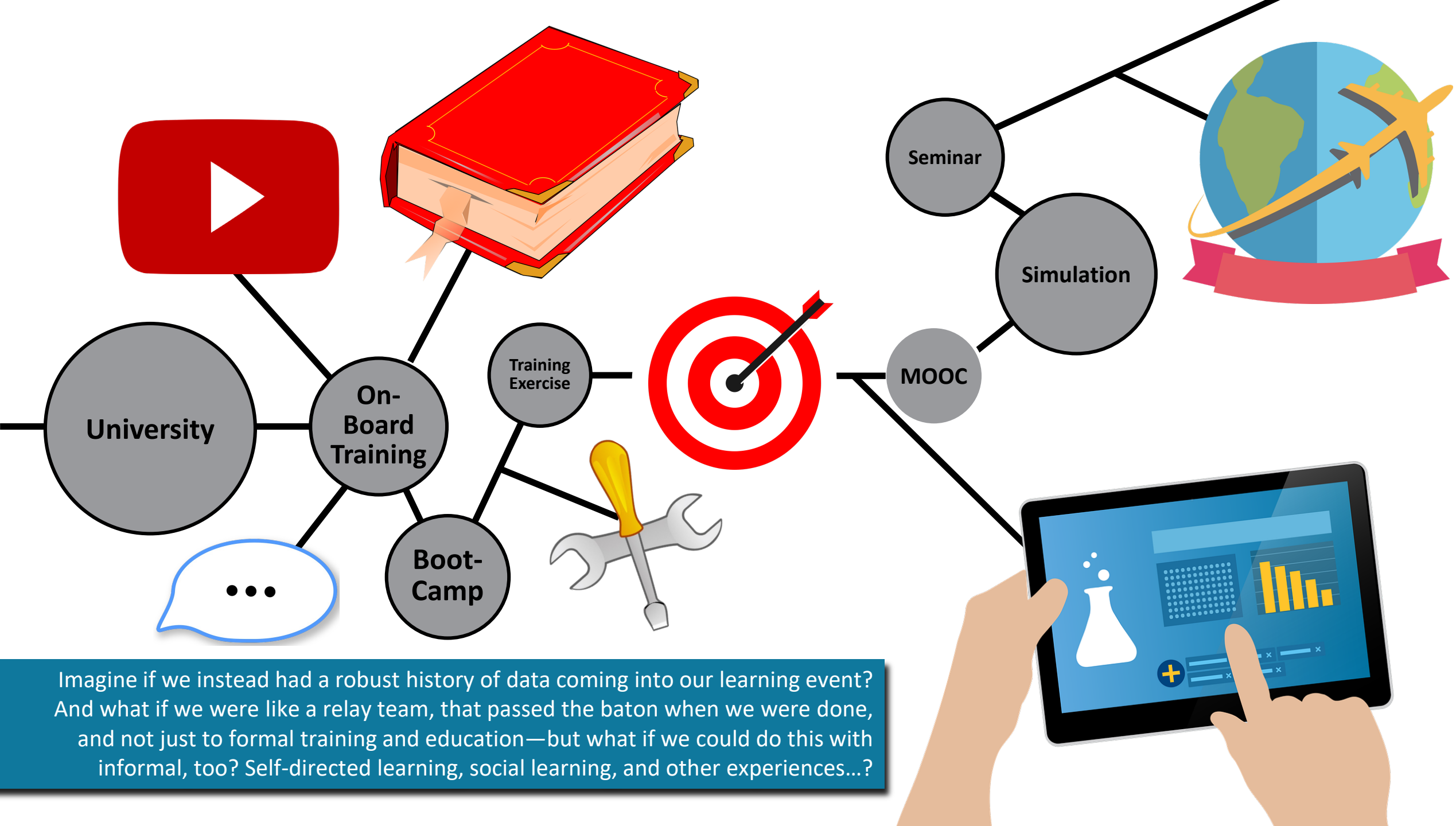
## Popularized by Ruben Puentedura

**WARNING: Consider how you're applying new technologies—are you using them in the same old ways?**

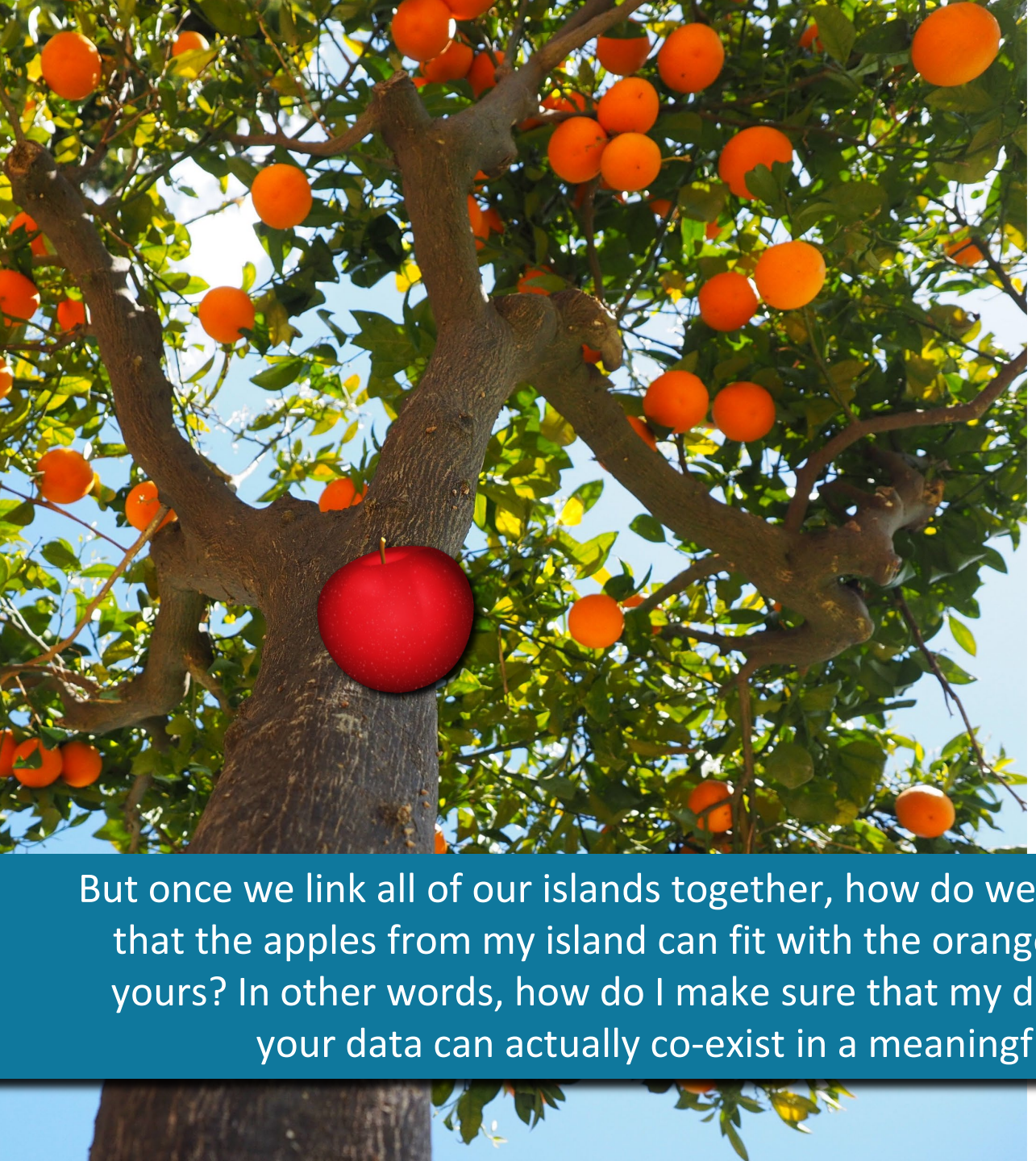

What should
we all do?


stop building
leazning islands !!
❶ CONTINUUM OF LEARNING

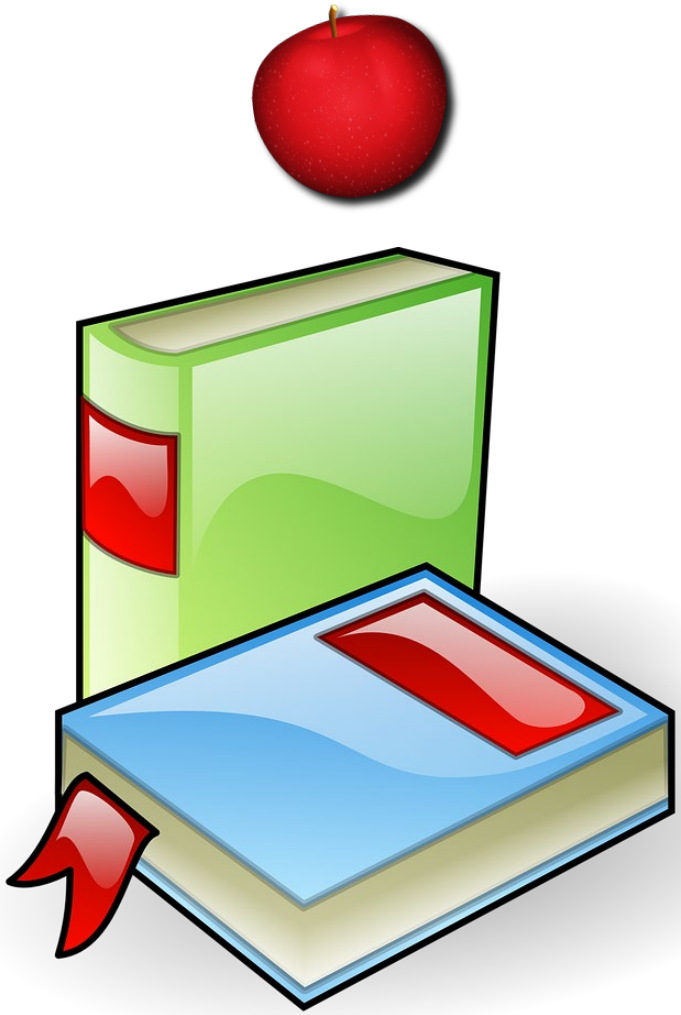

Imagine this bullseye is your learning experience—maybe it's a simulation-based scenario, a schoolhouse course, or even an apprenticeship or on-the-job experience. What do you know about your students or trainees coming into the learning experience? And what data do you pass on to the next experience afterwards?




Imagine if we instead had a robust history of data coming into our learning event? And what if we were like a relay team, that passed the baton when we were done, and not just to formal training and education—but what if we could do this with informal, too? Self-directed learning, social learning, and other experiences…?



But once we link all of our islands together, how do we ensure that the apples from my island can fit with the oranges from yours? In other words, how do I make sure that my data and your data can actually co-exist in a meaningful way?

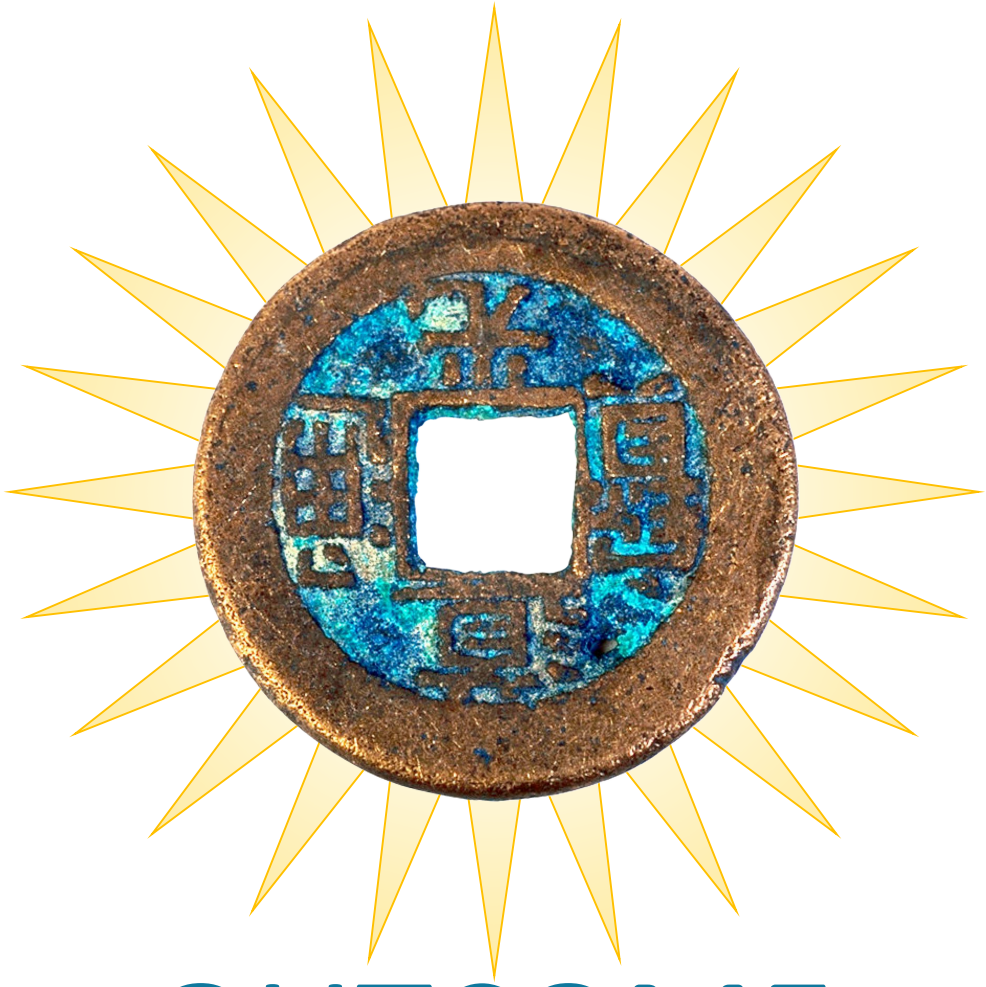


Specifically, how do we ensure that we talk about learning content, job and task requirements, and human performance in similar ways?


# ❷ COMMON CURRENCY


We do, sort of, have a common currency today: Time. But it’s not a good measure of human performance or learning outcomes.

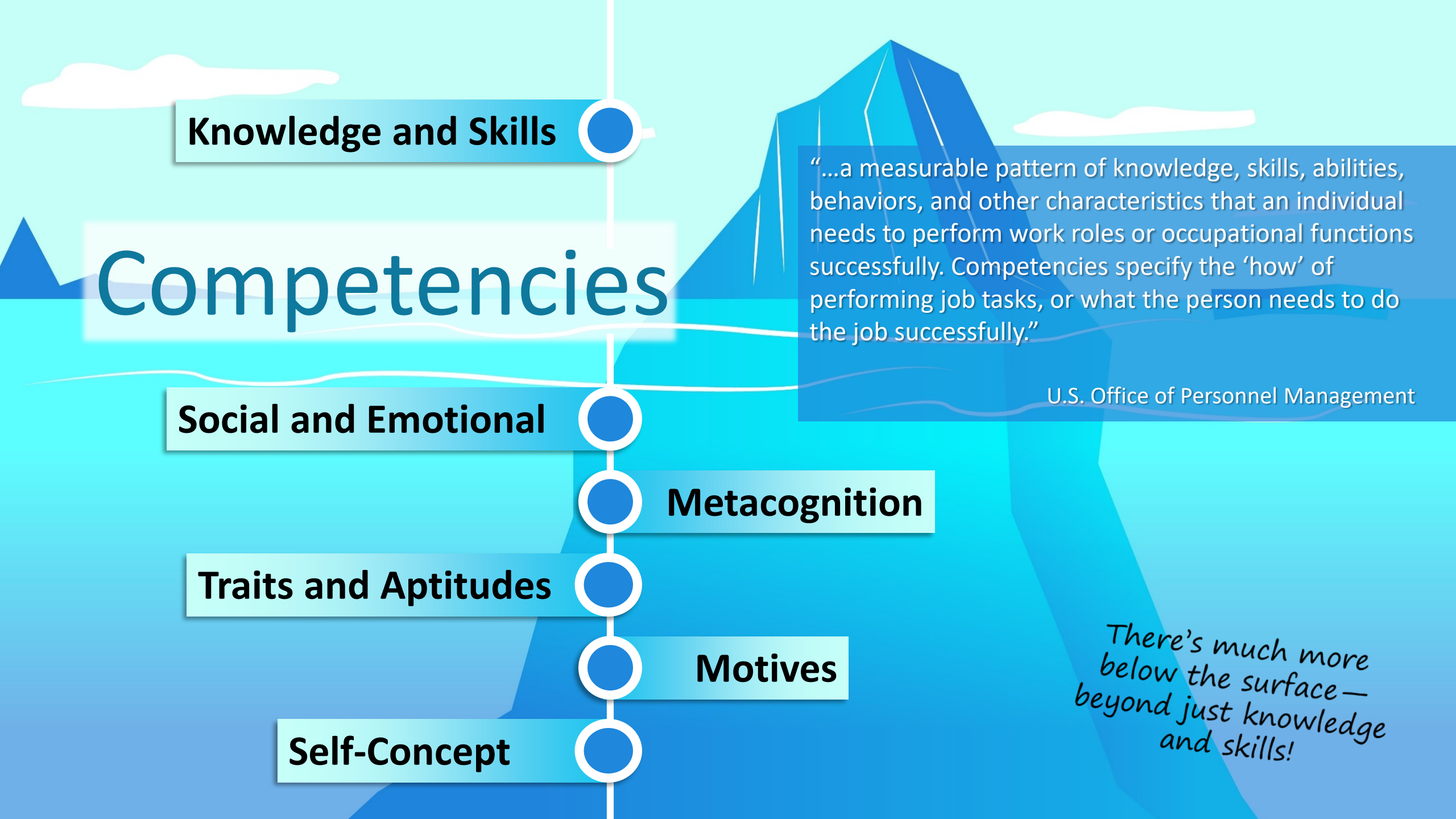

INPUT



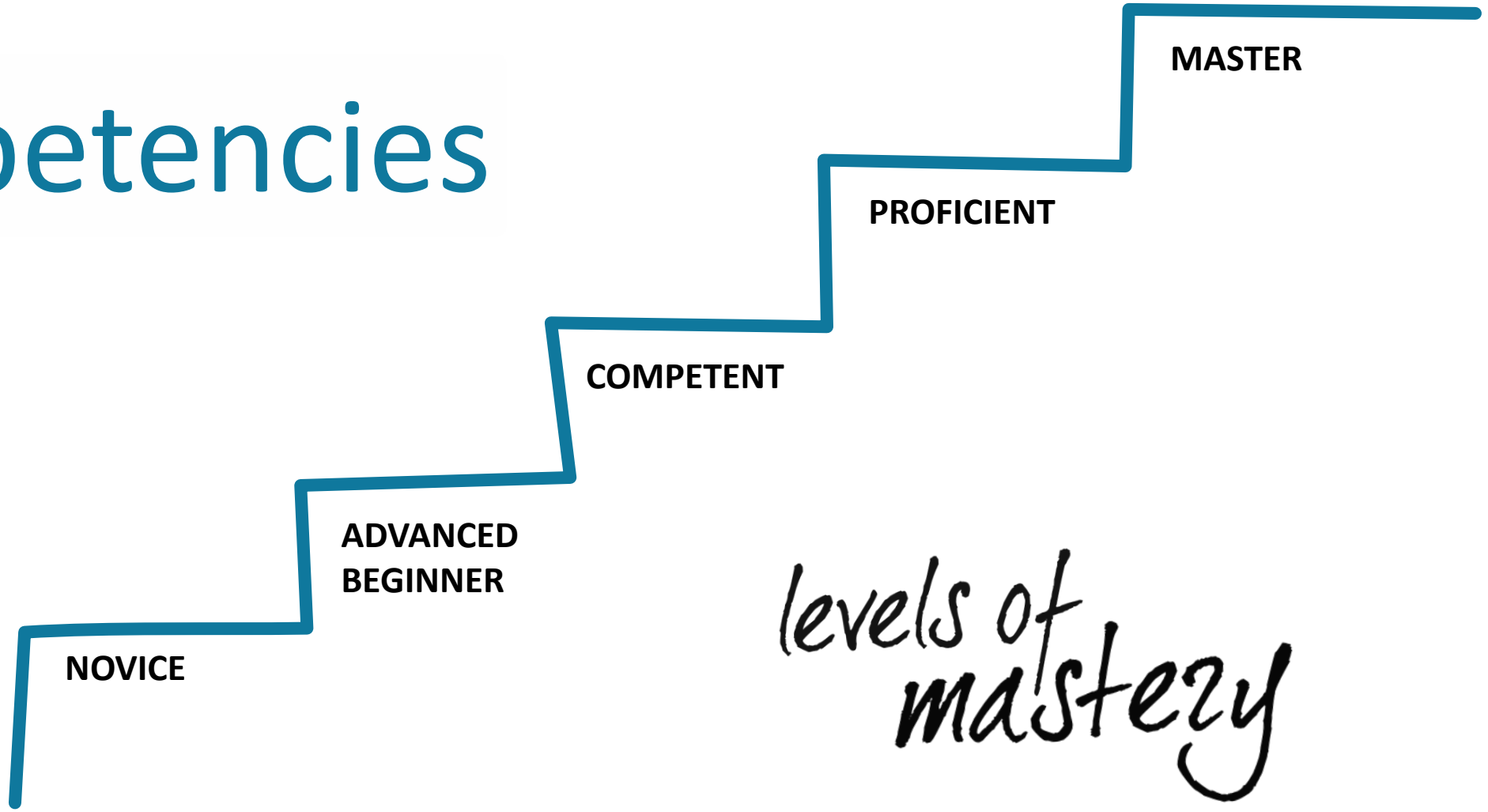
OUTCOME

Competencies
Credentials

OUTCOME

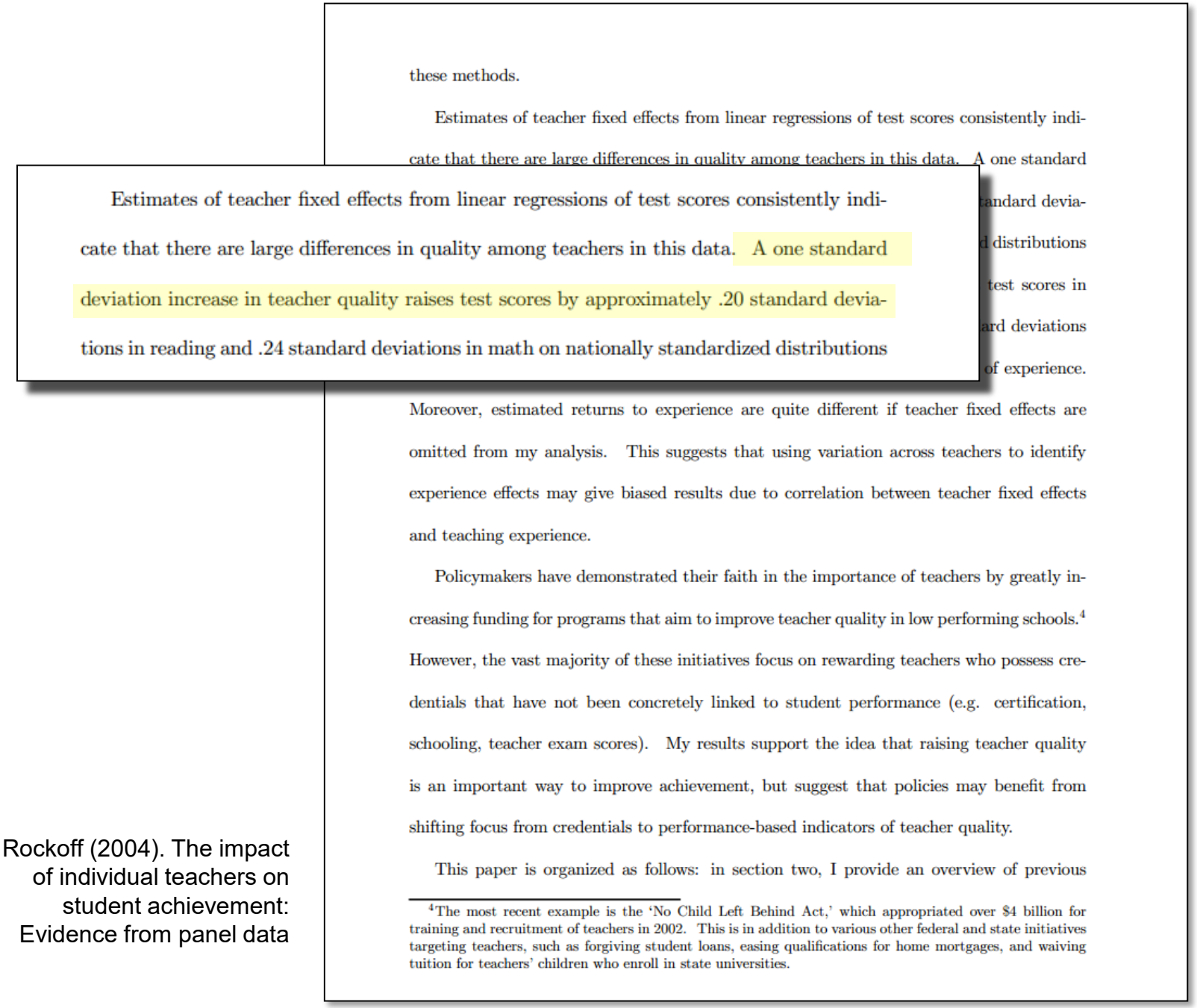

Knowledge and Skills
Competencies
"…a measurable pattern of knowledge, skills, abilities, behaviors, and other characteristics that an individual needs to perform work roles or occupational functions successfully. Competencies specify the 'how' of performing job tasks, or what the person needs to do the job successfully."
U.S. Office of Personnel Management
Social and Emotional
Metacognition
Traits and Aptitudes
Motives
Self-Concept
There's much more below the surface—beyond just knowledge and skills!

# Competencies




levels of mastery


❸ PROFESSIONALIZE



these methods.

Estimates of teacher fixed effects from linear regressions of test scores consistently indicate that there are large differences in quality among teachers in this data. A one standard deviation increase in teacher quality raises test scores by approximately .20 standard deviations in reading and .24 standard deviations in math on nationally standardized distributions

Moreover, estimated returns to experience are quite different if teacher fixed effects are omitted from my analysis. This suggests that using variation across teachers to identify experience effects may give biased results due to correlation between teacher fixed effects and teaching experience.

Policymakers have demonstrated their faith in the importance of teachers by greatly increasing funding for programs that aim to improve teacher quality in low performing schools.[4] However, the vast majority of these initiatives focus on rewarding teachers who possess credentials that have not been concretely linked to student performance (e.g. certification, schooling, teacher exam scores). My results support the idea that raising teacher quality is an important way to improve achievement, but suggest that policies may benefit from shifting focus from credentials to performance-based indicators of teacher quality.

This paper is organized as follows: in section two, I provide an overview of previous

[4]The most recent example is the 'No Child Left Behind Act,' which appropriated over $4 billion for training and recruitment of teachers in 2002. This is in addition to various other federal and state initiatives targeting teachers, such as forgiving student loans, easing qualifications for home mortgages, and waiving tuition for teachers' children who enroll in state universities.

Rockoff (2004). The impact of individual teachers on student achievement: Evidence from panel data

Quality teachers have profound impacts on student learning outcomes

their increases in earnings. Consider, for example, a teacher with a class of 20 students. Under such circumstances, the teacher at the 60th percentile will—each year—raise students' aggregate earnings by a total of $106,000. The impact of one at the 69th percentile (as compared to the average) is $212,000, and one at the 84th percentile will shift earnings up by more than $400,000.

But there is also symmetry to these calculations. A very low performing teacher (at the 16th percentile of effectiveness) will have a negative impact of $400,000 compared to an average teacher.

A good, but not great, teacher increases each student's lifetime earnings by $10,600. Given a class of 20 students, she will raise their aggregate earnings by $212,000.

Measuring Teachers' Impact

...have worked hard to isolate the impact of teach-
...other influences.
...impact of a more-
...rming teacher, on
...n compared with
...ts whose level of a
...ns higher by the e
...having such a teac
...d deviations.
...acts attenuate som
...ough less than defi
...e gains achieved th
...tudent. The persis
...cause the more su
...e positive impact
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...suggests that a te
...will have a positiv
one standard deviation above average can later in life expect to ... average teacher) on longer-ter
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Does 10 to 15 percent amount to much? For the average American entering the labor force, the value of lifetime earnings for full-time work is currently $1.16 million. Thus, an increase in the level of achievement in high school of a standard deviation yields an average increase of between $110,000 and $230,000 in lifetime earnings.

How do increases in teacher effectiveness relate to this? Obviously, teacher quality is not the only factor that affects student achievement. The student's own motivations and support from family and peers play crucial roles as well. But ...e at the 69th percen... age) is $212,000, and one at the ...ings up by more than $400,000.

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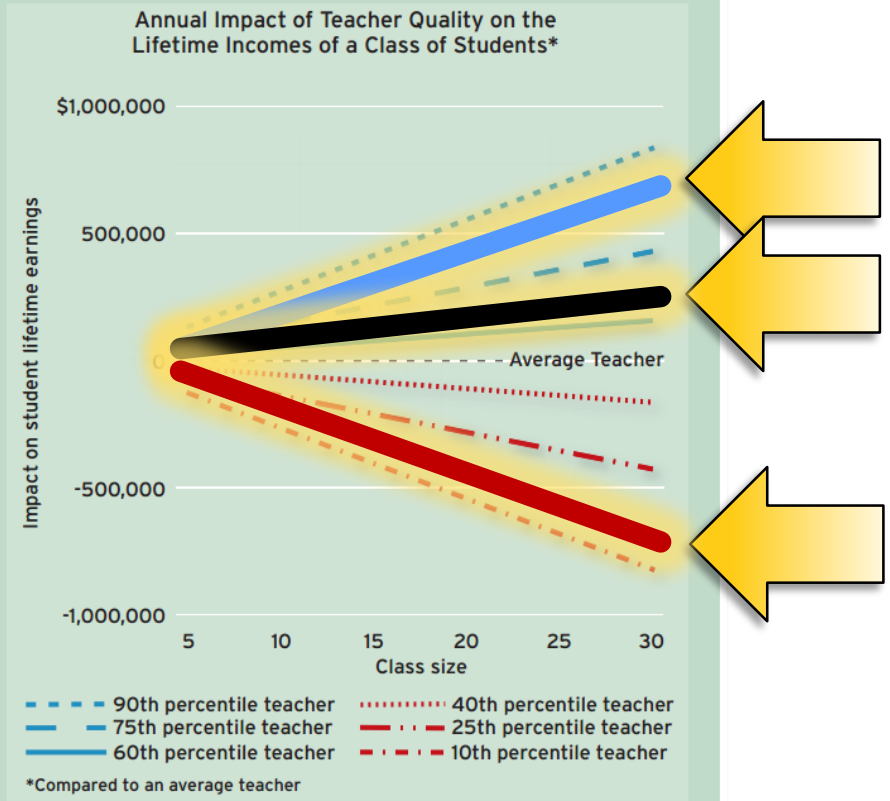
Moreover, the economic value of an effective teacher grows with larger classes, as do the economic losses of an ineffective teacher. Figure 1 illustrates the aggregate impact on students'



## Effective Teachers Raise Students' Earnings
**(Figure 1)**

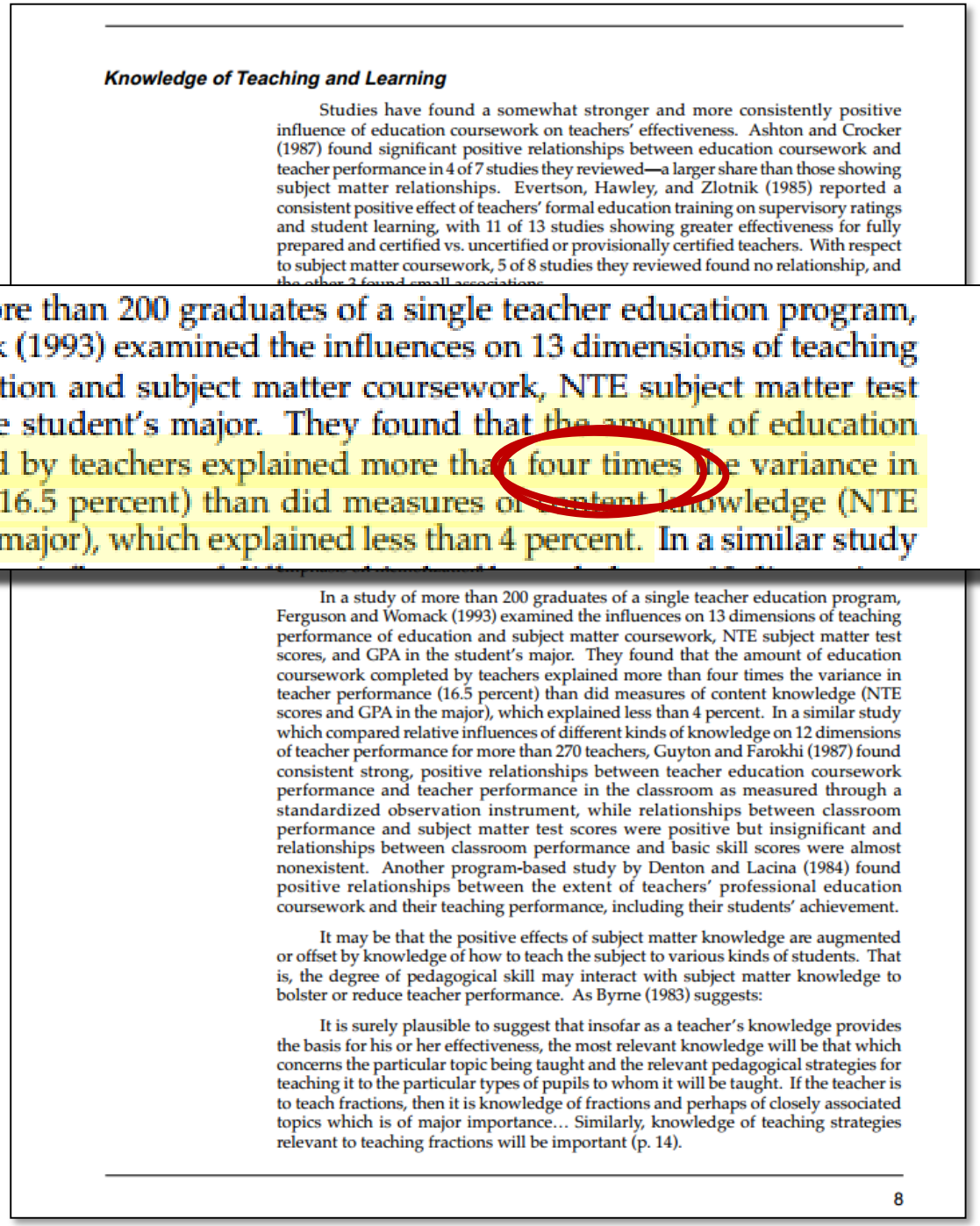
*The economic value of an effective teacher grows with larger classes, and the economic costs of having an ineffective teacher are substantial.*




SOURCE: Authors' calculations

Hanushek (2011). How much is a good teacher worth?

The impact of a high-quality (or poor-quality) teacher a can have a lifelong influence



***Knowledge of Teaching and Learning***

Studies have found a somewhat stronger and more consistently positive influence of education coursework on teachers' effectiveness. Ashton and Crocker (1987) found significant positive relationships between education coursework and teacher performance in 4 of 7 studies they reviewed—a larger share than those showing subject matter relationships. Evertson, Hawley, and Zlotnik (1985) reported a consistent positive effect of teachers' formal education training on supervisory ratings and student learning, with 11 of 13 studies showing greater effectiveness for fully prepared and certified vs. uncertified or provisionally certified teachers. With respect to subject matter coursework, 5 of 8 studies they reviewed found no relationship, and

In a study of more than 200 graduates of a single teacher education program, Ferguson and Womack (1993) examined the influences on 13 dimensions of teaching performance of education and subject matter coursework, NTE subject matter test scores, and GPA in the student's major. They found that the amount of education coursework completed by teachers explained more than four times the variance in teacher performance (16.5 percent) than did measures of content knowledge (NTE scores and GPA in the major), which explained less than 4 percent. In a similar study

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It may be that the positive effects of subject matter knowledge are augmented or offset by knowledge of how to teach the subject to various kinds of students. That is, the degree of pedagogical skill may interact with subject matter knowledge to bolster or reduce teacher performance. As Byrne (1983) suggests:

It is surely plausible to suggest that insofar as a teacher's knowledge provides the basis for his or her effectiveness, the most relevant knowledge will be that which concerns the particular topic being taught and the relevant pedagogical strategies for teaching it to the particular types of pupils to whom it will be taught. If the teacher is to teach fractions, then it is knowledge of fractions and perhaps of closely associated topics which is of major importance… Similarly, knowledge of teaching strategies relevant to teaching fractions will be important (p. 14).

8

Darling-Hammond (1999). Teacher quality and student achievement: A review of state policy evidence.

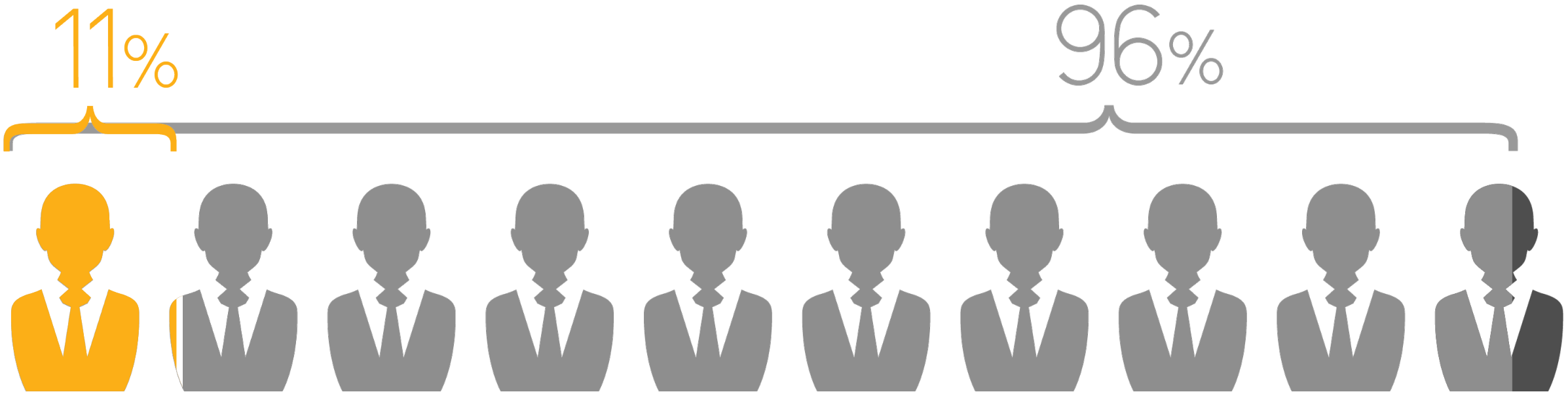
Teachers' knowledge and skill in the practice of education is more important than their content expertise—the context, delivery, and other pedagogical (or andragogical) factors matter significantly


People who can “teach themselves” (self-regulate their learning) also have a major advantage. According to one meta-analysis, this ability accounts for 17% of the variance in learning outcomes.

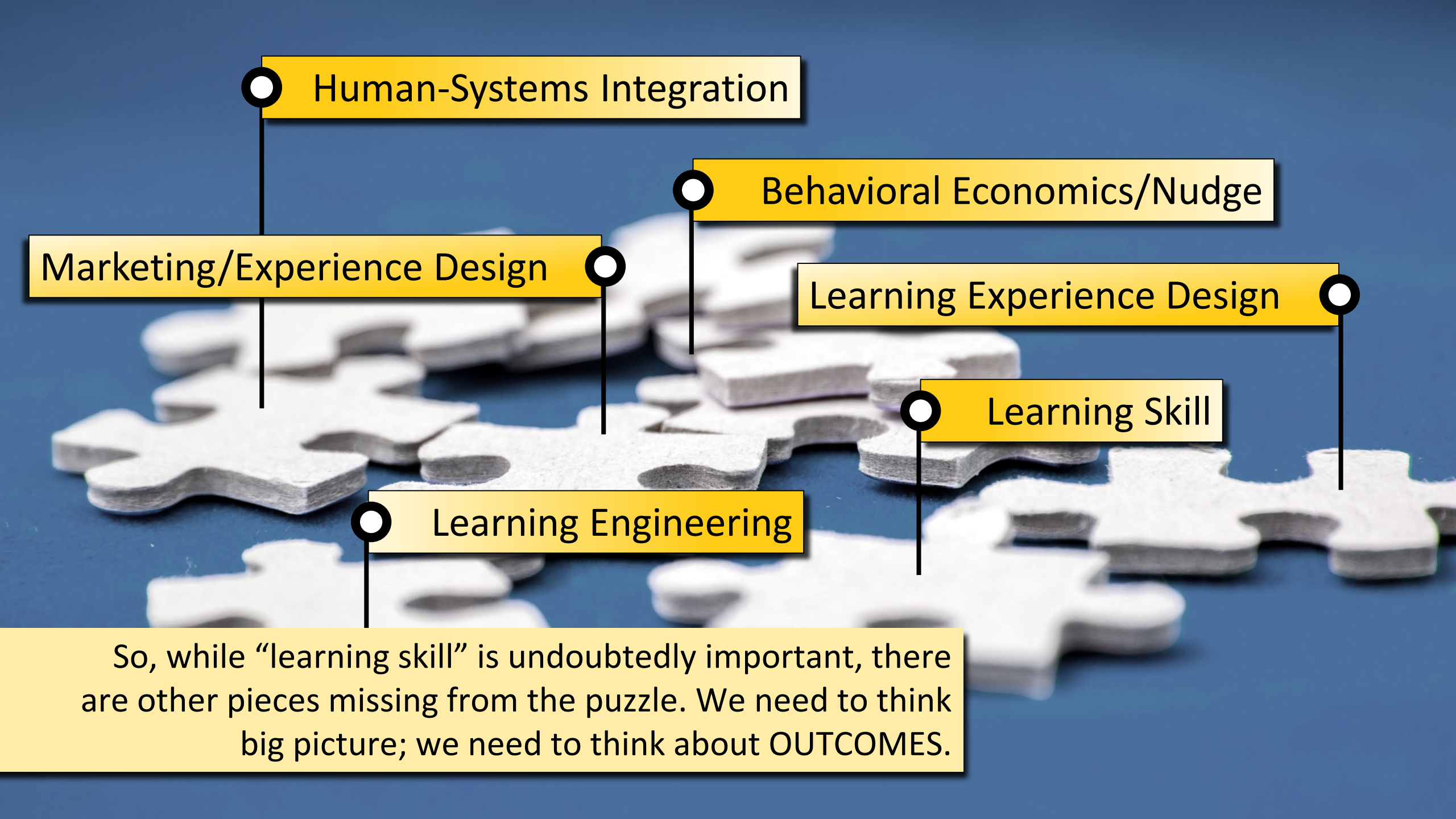
Sitzmann, T., & Ely, K. (2011). A meta-analysis of self-regulated learning… *Psychological Bulletin*

According to polls conducted jointly by Gallup and the Lumina Foundation, **96% of chief academic officers** at higher education institutions felt their programs were **“very” or “somewhat” effective** at preparing students for the world of work

—but only **11% of business leaders strongly agreed**. Business leaders said graduates lack the skills and competences their companies actually need.




Source: Preety Sidhu and Valerie J. Calderon (2016). https://news.gallup.com




So, while “learning skill” is undoubtedly important, there are other pieces missing from the puzzle. We need to think big picture; we need to think about OUTCOMES.

**52** SME contributors from academia, education, government, military, non-profits, and industry

**35** Authors

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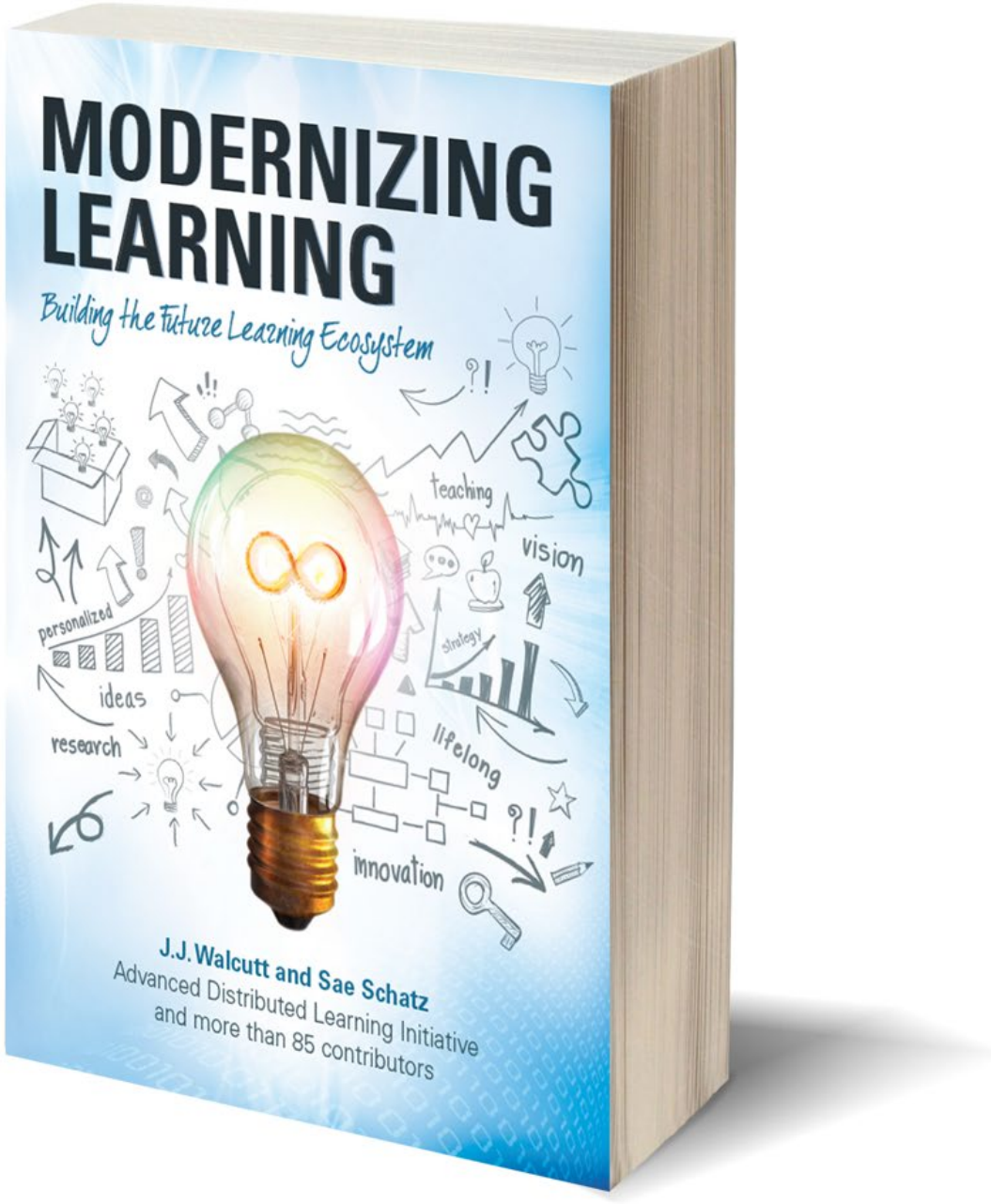

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