

Modernizing Learning

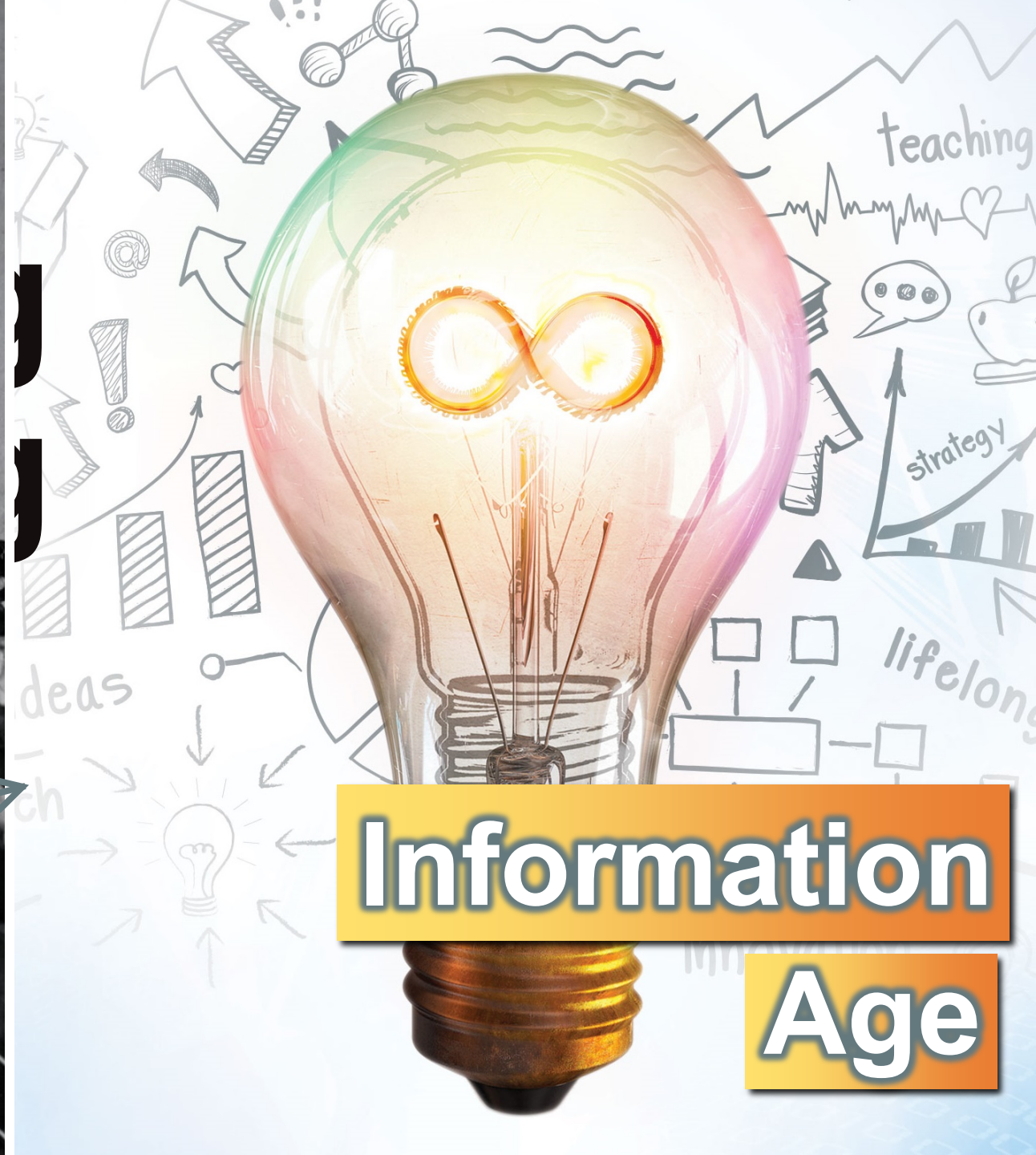
Sae Schatz, Ph.D.
ADL Initiative





Industrial

Age



Information

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





- Lifelong continuous
- Interconnected like
- Personalized-all
- Outcome-focused
- Active
- Focused on fostering 21st century competencies or skills from experts to students



- Lifelong continuum

Future

- Interconnected

- Personalized

Learning

- Outcome-focused

Ecosystem

- Active

- Focused on fostering 21st century competencies

Why?

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UNITED STATES SPECIAL OPERATIONS COMMAND

Special Operations Forces Operating Concept



A Whitepaper to Guide Future Special Operations Force Development

Directorate of Force Management and Development

Concept Development and Integration Office

Version 1.0

1 February 2016

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 development program under the Deputy Assistant Secretary of Defense for Force Education and Training.

Jennifer Vogel-Walcutt, Ph.D. is the Director of Innovation at the ADL Initiative. She has over 15 years of experience in research and development for training and education with specific interests in applying instructional techniques to improve the effectiveness and efficiency of cognition and educational development.

Kendy Vierling, Ph.D. serves as the Director of the Future Learning Group (FLG) and lead for science and technology at the United States Marine Corps (USMC) Training and Education Command (TECOM). Her work focuses on the development of innovative methodologies, science, and technologies to enhance military learning, resilience, and human performance.

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



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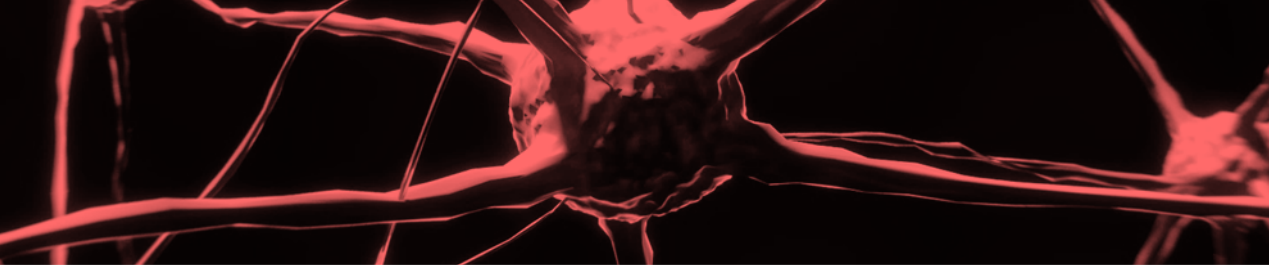
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OPERATIONAL DEMANDS



60-YEAR CURRICULUM



HUMANS + AI



SUBSTITUTION

AUGMENTATION

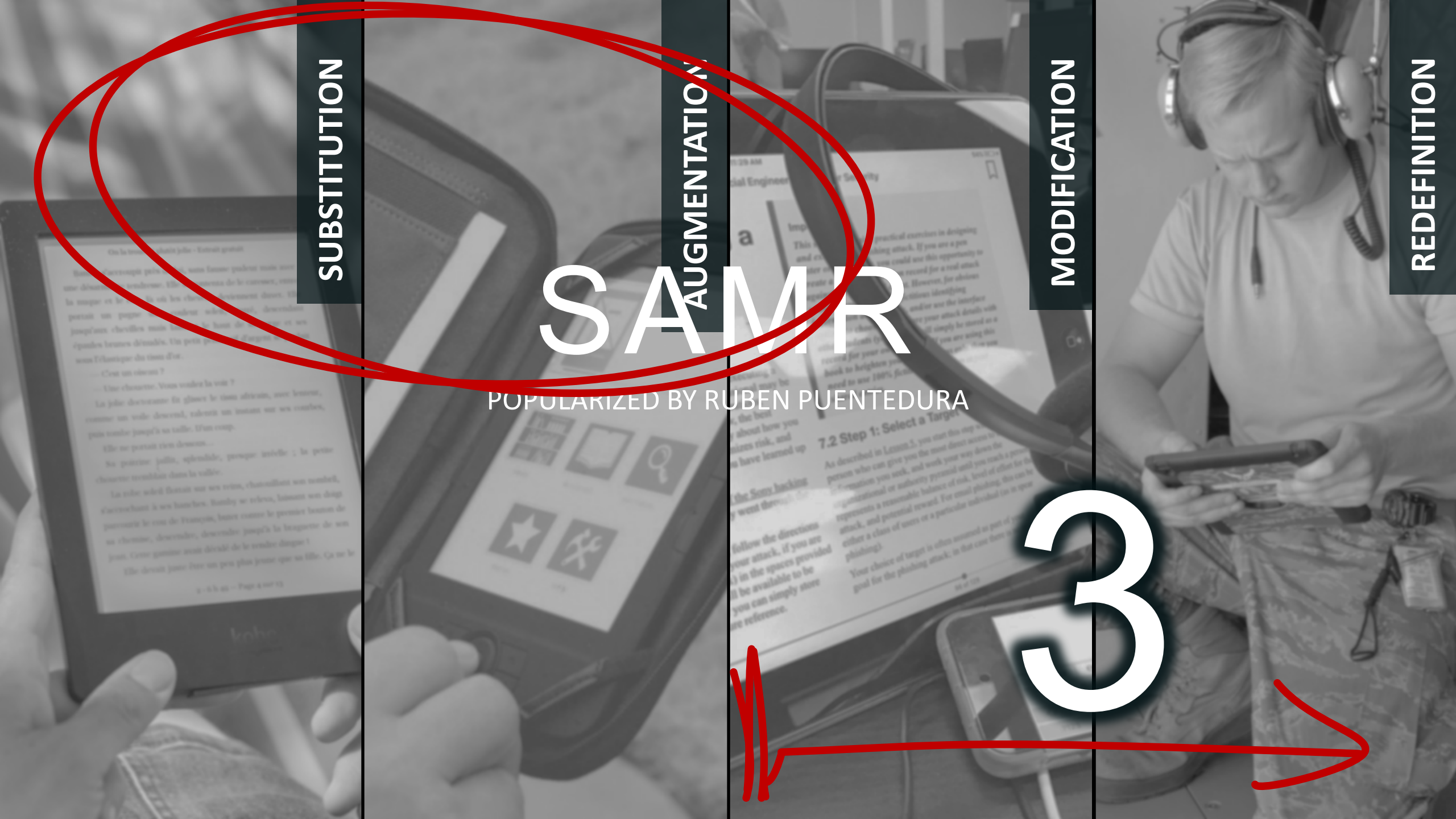
MODIFICATION

REDEFINITION

SAMR

POPULARIZED BY RUBEN PUENTEDURA

3



stop building
learning islands !!



1 CONTINUUM OF LEARNING





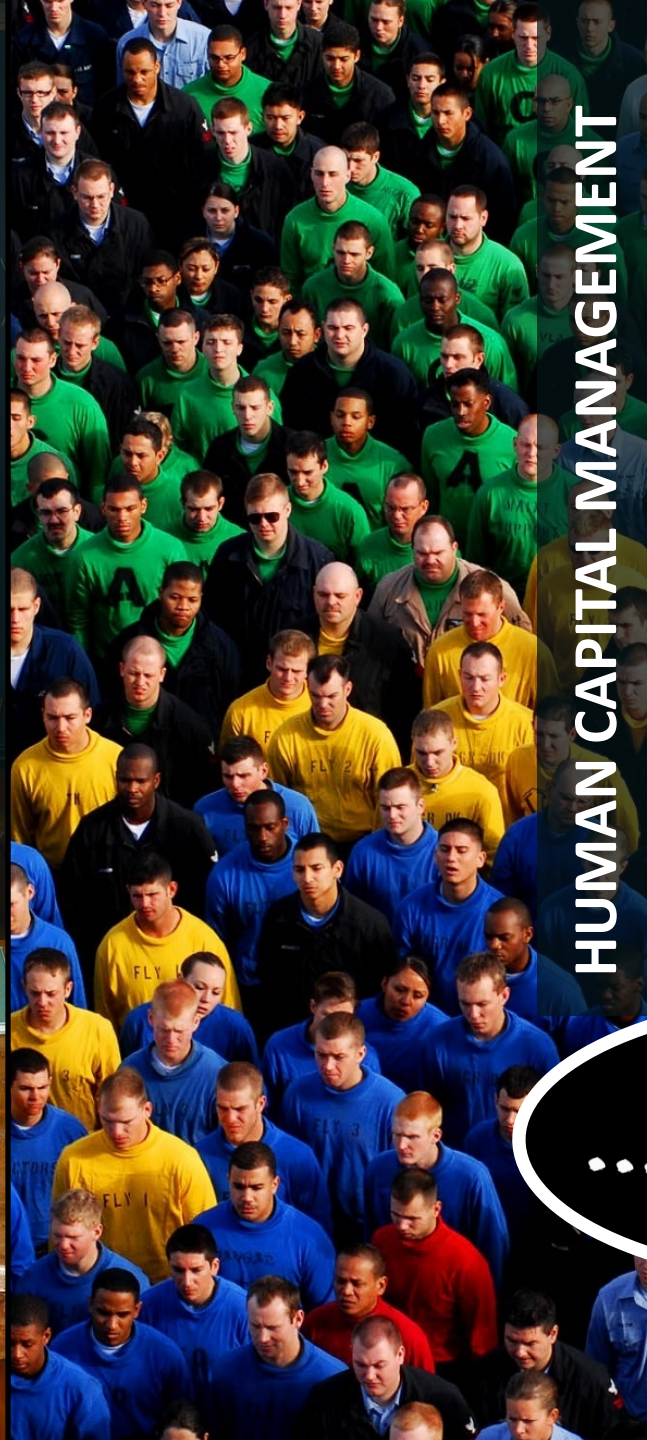


PERSONALIZE

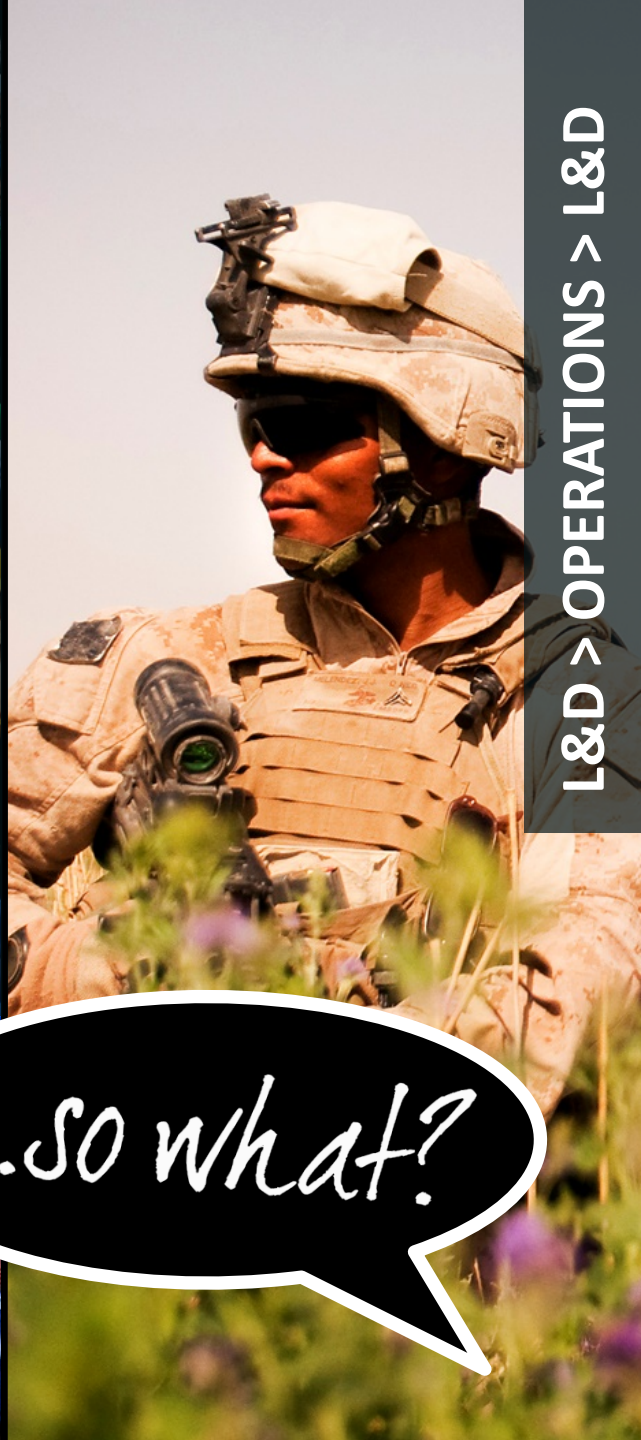


Am Nm Oo Pp Qq Rr
2
69 43
+10 +35
59 33
-42 -16
Public School
Reading
Writing
Arithmetic
Singing
Science
Social Studies
Spelling

CONTINUOUS IMPROVEMENT



HUMAN CAPITAL MANAGEMENT



L&D > OPERATIONS > L&D

...so what?







INPUT



OUTCOME

Competencies
Credentials



OUTCOME

Competencies
Credentials



Competencies

Knowledge and Skills

Social and Emotional

Traits and Aptitudes

Self-Concept

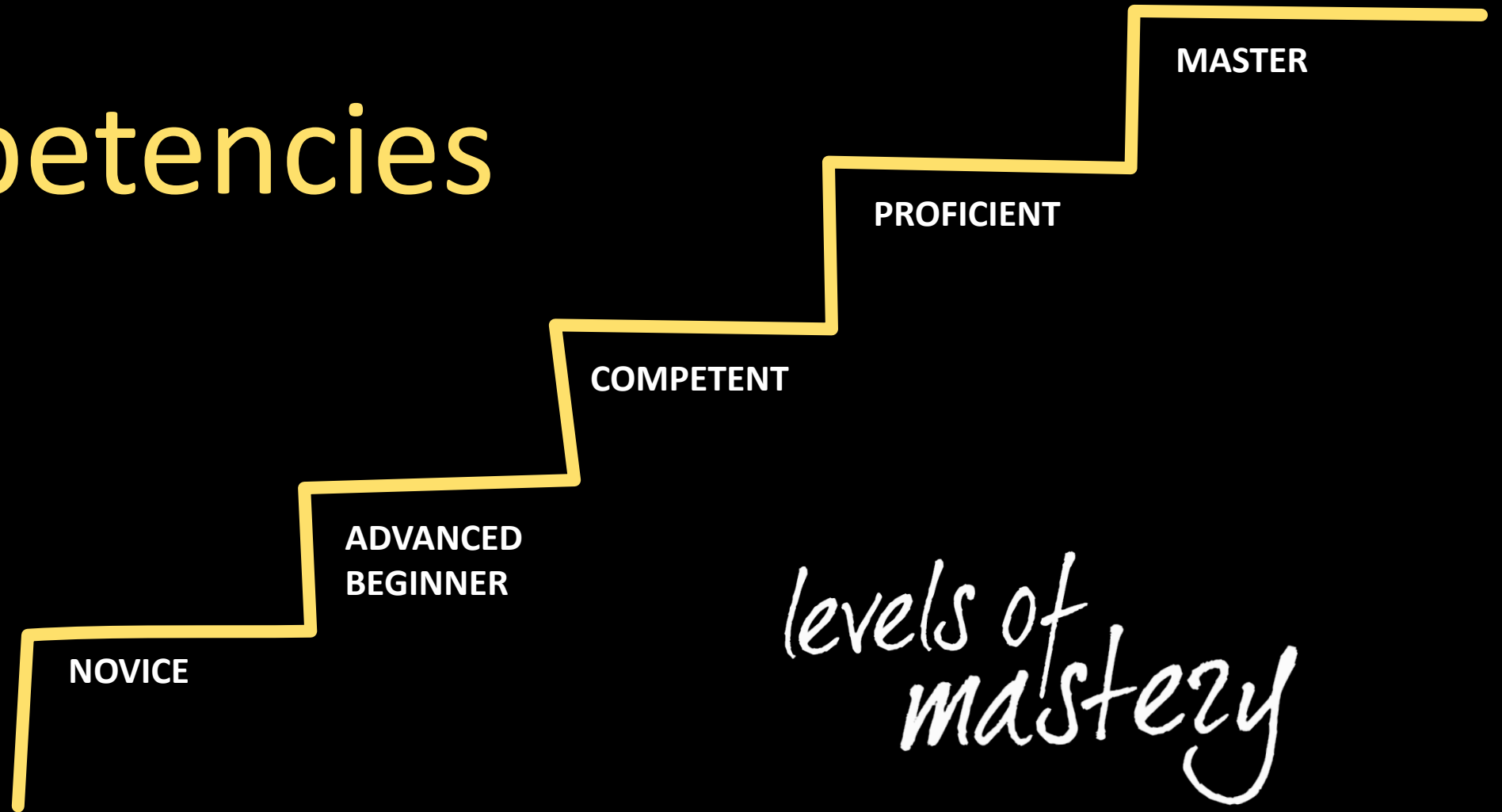
Metacognition

Motives

“...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 what the person needs to do the job successfully.”

U.S. Office of Personnel Management

Competencies





OUTCOMES QUALITY



PORTABILITY



SYSTEM EFFICIENCY



EQUITY AND MERITOCRACY



③ 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

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

≈35% increase in teacher skill

≈8-9% student achievement increase

over, estimated returns to experience are quite different if teacher fixed effects are included 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

⁴The 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.

Quality teachers have profound impacts on student learning outcomes

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

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.

Does a 10 to 15 percent amount to much? For the average American earning the labor force, the average lifetime earnings for full-time work is currently \$1.16 million. Thus, an increase in the level of achievement in high school of one 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

researchers have worked hard to isolate the impact of teach-

other influences. The impact of a more-effective teacher, on average, is higher by the amount of having such a teacher in the classroom.

Effects attenuate somewhat, but not enough to offset the gains achieved through the positive impact of a teacher. The persistence of the positive impact suggests that a teacher will have a positive impact on longer-term earnings.

Immediate gains. That is, we will use as we combine a teacher's labor market value with some conservative estimate of all the gains a teacher will have over the average teacher on longer-term earnings. That is, we will use as we combine a teacher's labor market value with some conservative estimate of all the gains a teacher will have over the average teacher on longer-term earnings.

Even a modest increase in earnings (60th percentile) of \$5,300, compared to the average, can be expected. While those gains are dramatic, every student who is taught by a teacher with such a positive impact will raise their aggregate earnings by \$106,000.

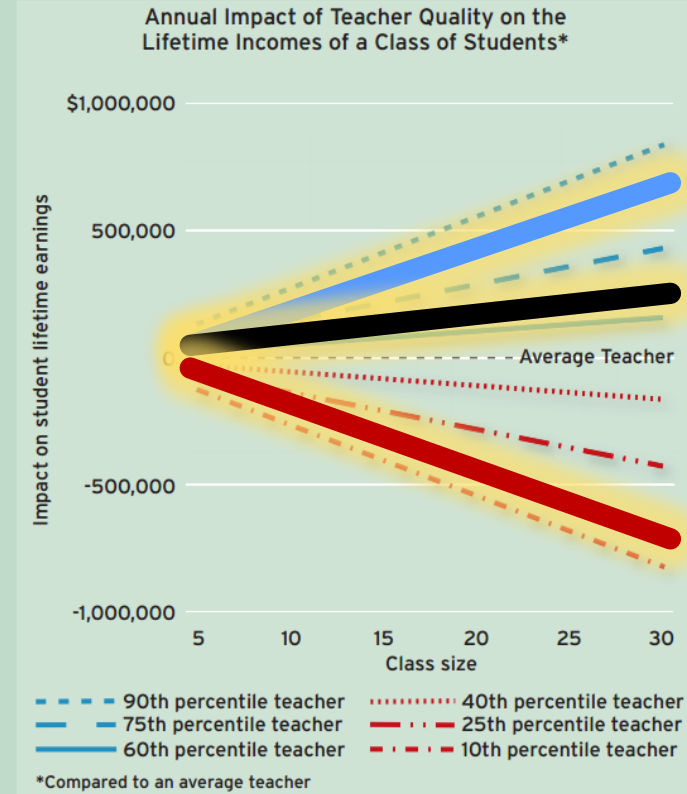
One at the 69th percentile will raise aggregate earnings by more than \$400,000.

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.

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'

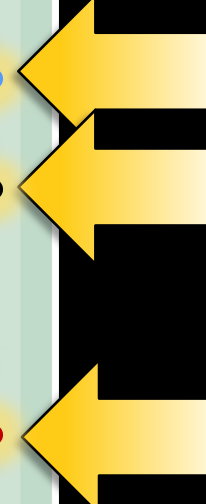
Effective Teachers Raise Students' Earnings (Figure 1)

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

Students can have a significant influence



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

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 the other 3 found small associations.

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).

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

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



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

People who can “teach themselves” (self-regulate learning) also have a major advantage

8-16%

Facilitation of Learning in Others



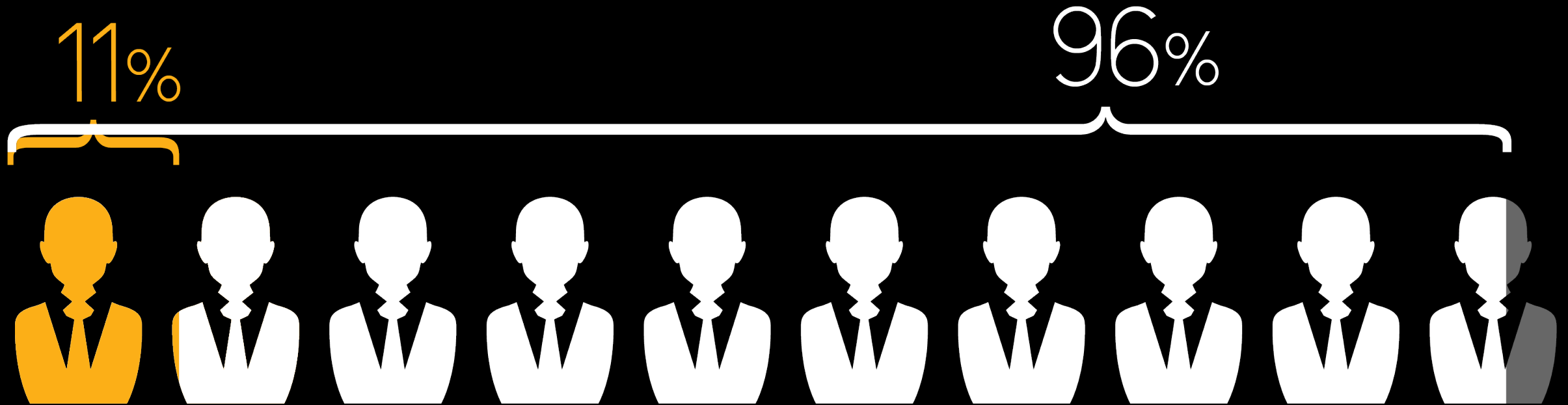
Achievement!

17%

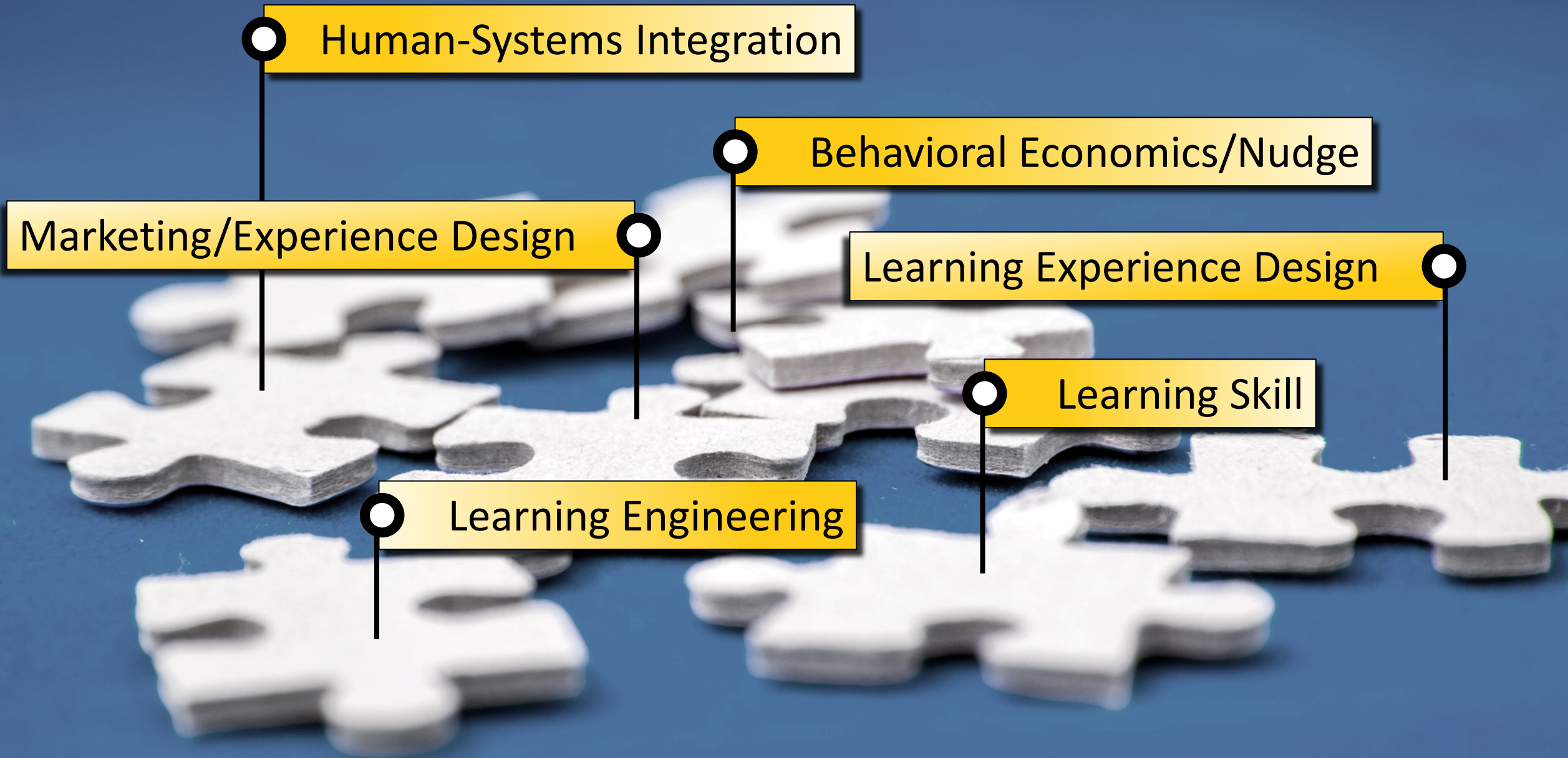
Self-Regulated Learning



According to 11% of business leaders, strongly agreed. Business
Executives and 96% of chief executive officers reported that education
institutions felt that programs were "very" or "somewhat"
effective at preparing students for the world of work







Human-Systems Integration

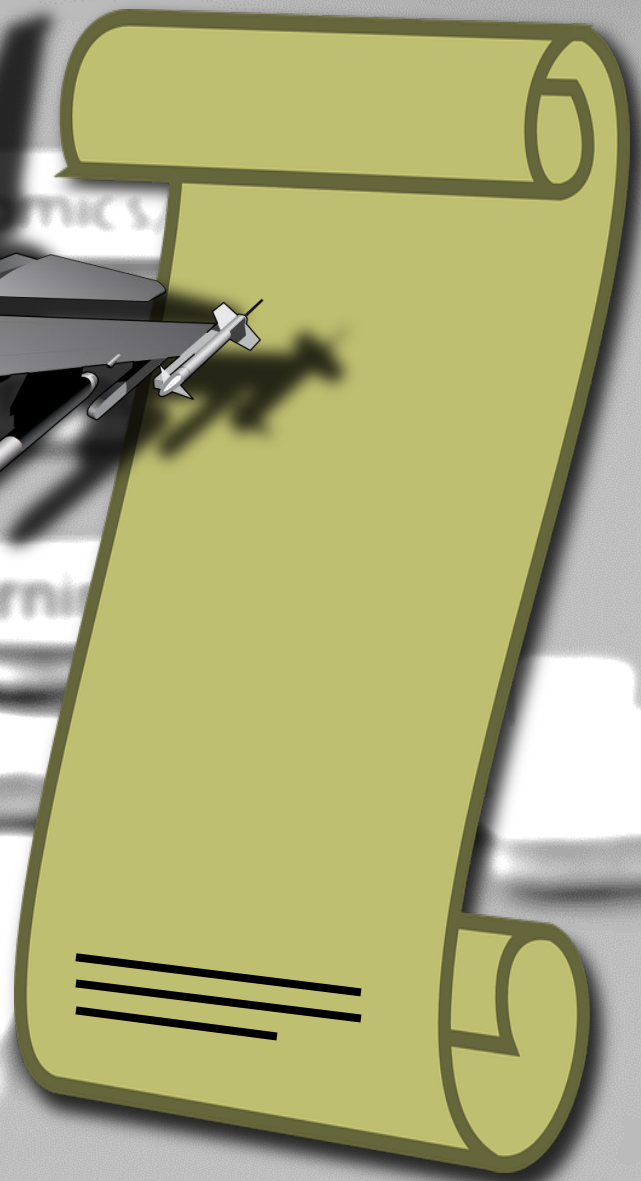
Behavioral Economics

Marketing/Experience Design



Learning

Learning Engineering

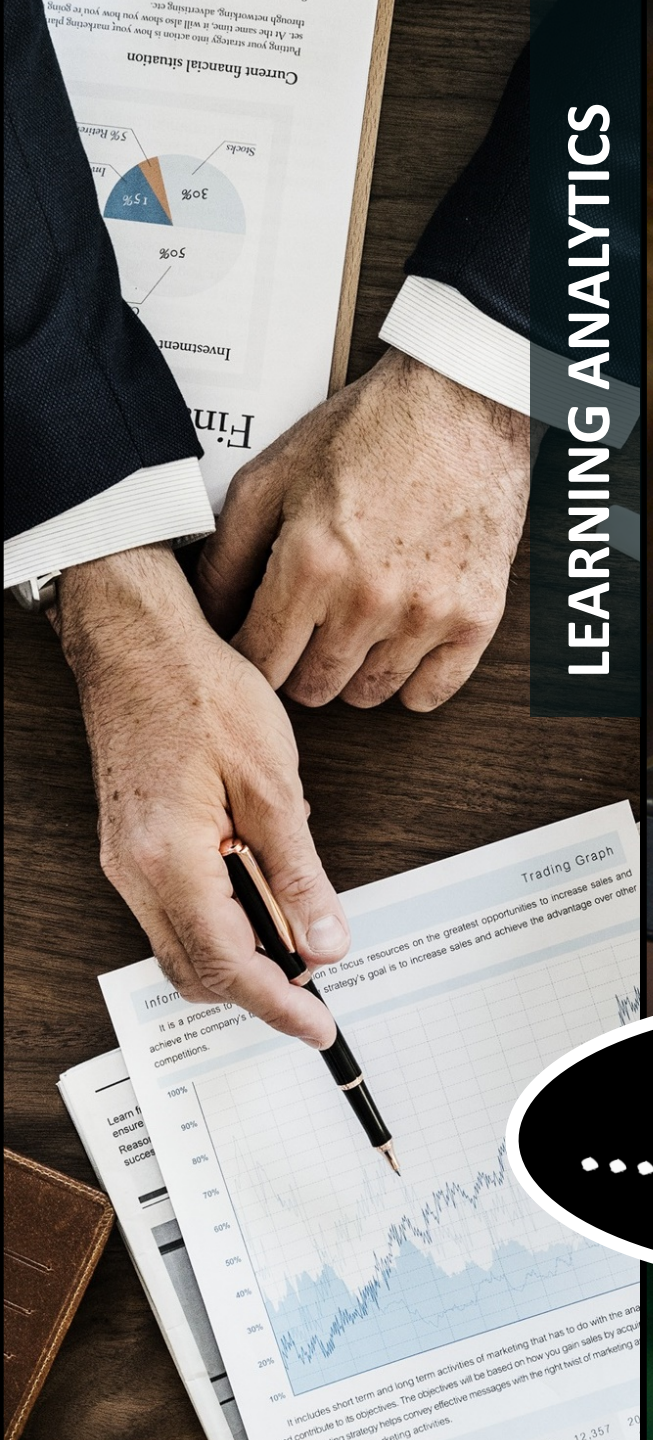




EMPHASIZE LEARNING SCIENCE LOCALLY



HOLISTIC LEARNING ENGINEERING



LEARNING ANALYTICS



...so what?

INCREMENTAL ENHANCEMENTS (A|B)

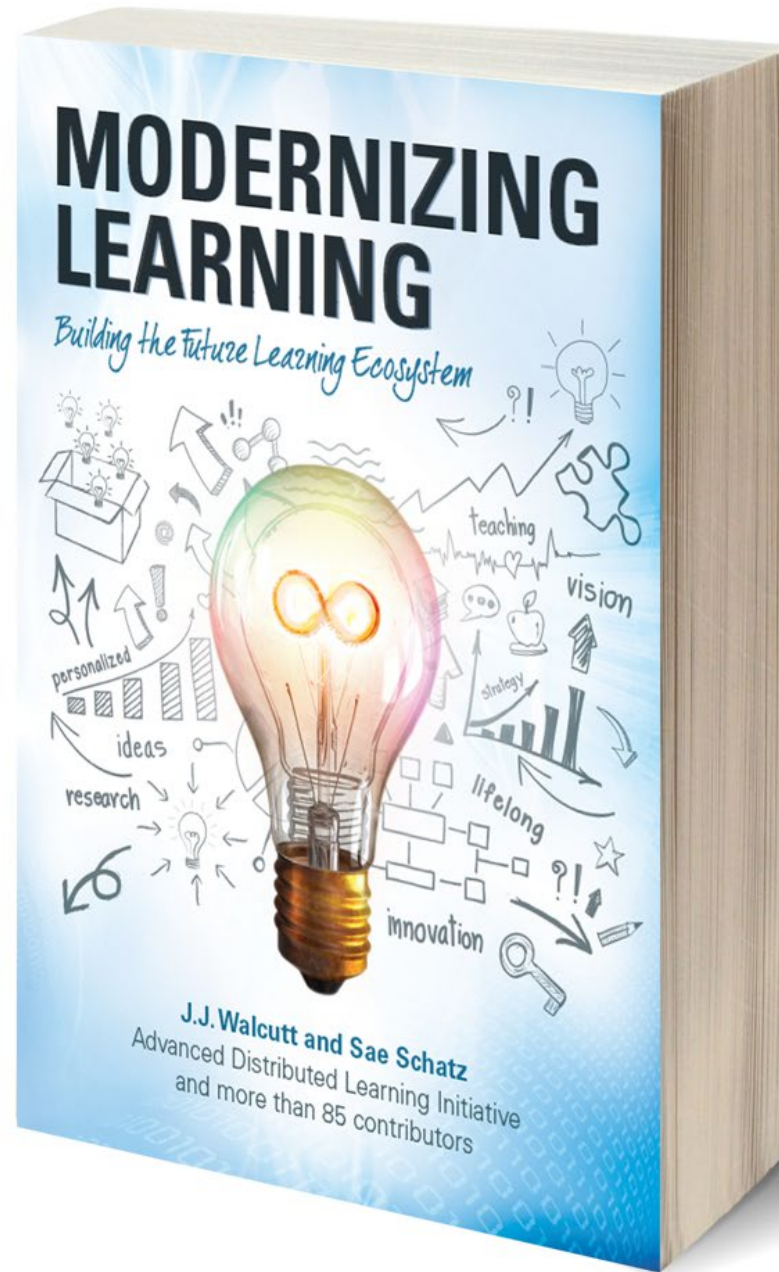


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35 Authors

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Federal E-learning Science & Technology

³iFEST

innovation • instruction • implementation



26-28 August 2019

Abstracts accepted until 17 May (Friday)!

<https://adlnet.gov/ifest-2019>



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