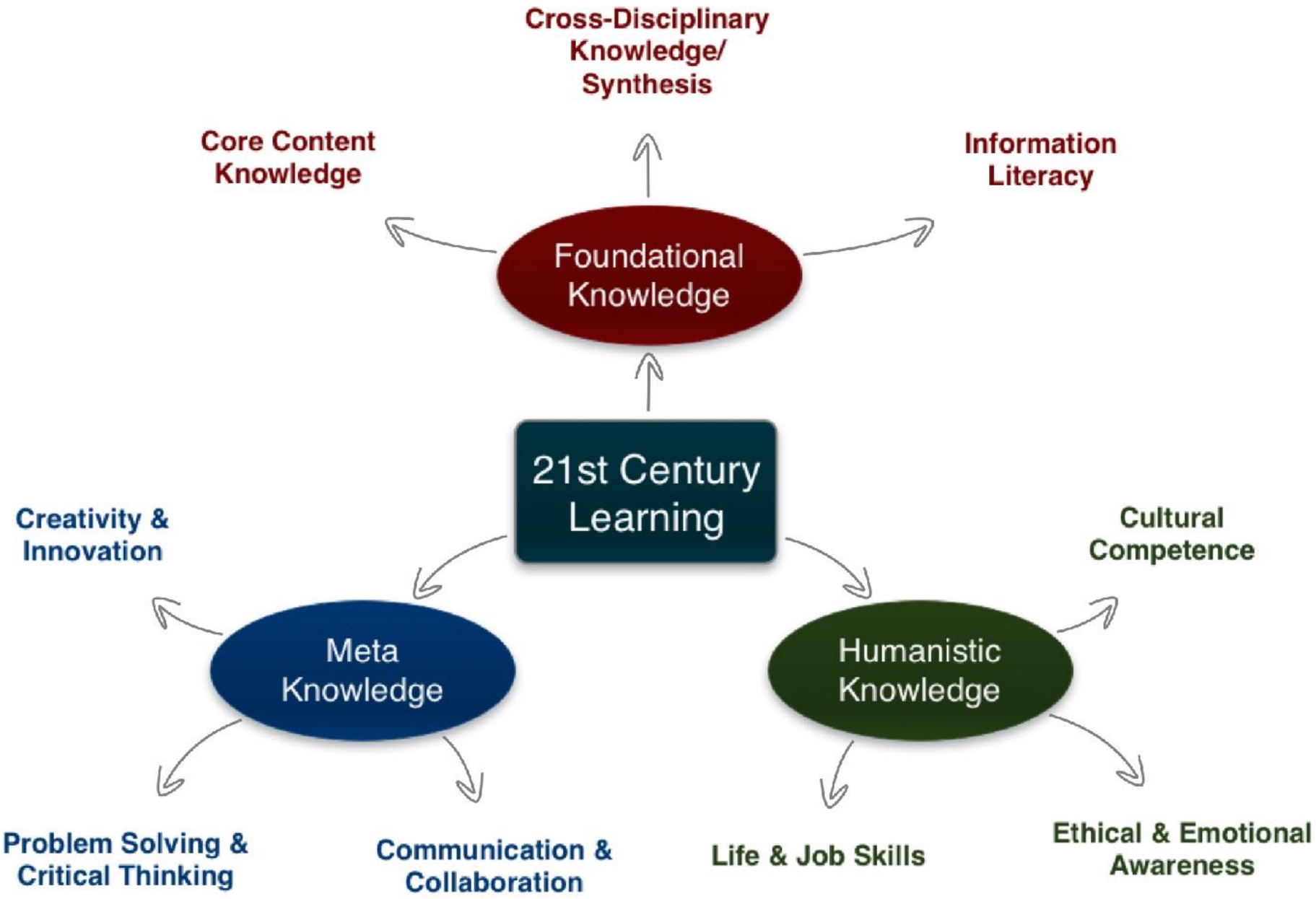
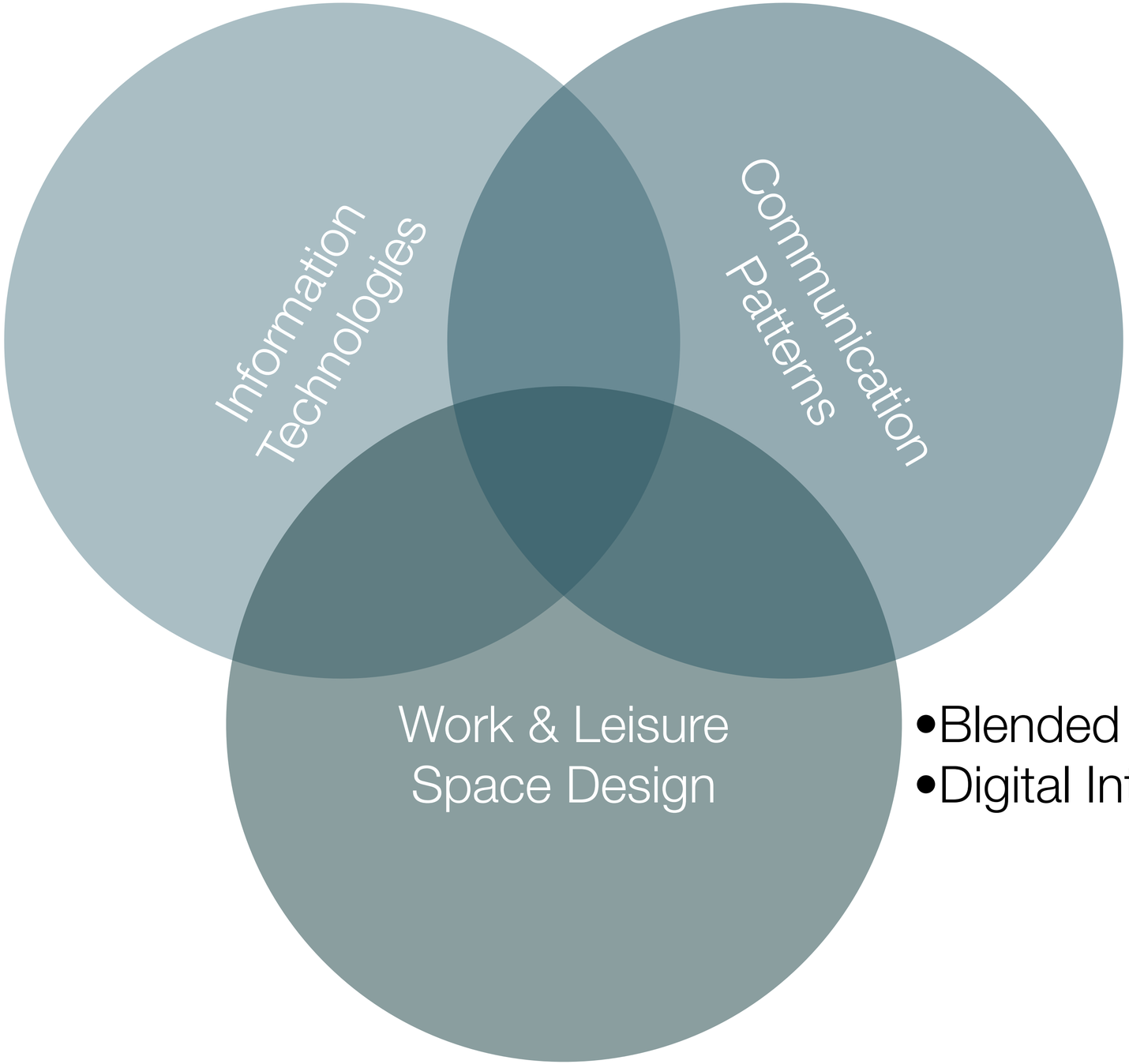
Science, Learning, and Exploration: SAMR and the EdTech Quintet

Ruben R. Puentedura, Ph.D.



Kristen Kereluik, Punya Mishra, Chris Fahnoe, and Laura Terry, "What Knowledge Is of Most Worth: Teacher Knowledge for 21st Century Learning". *Journal of Digital Learning in Teacher Education (29)* 4 (2013)

- Computing Power
- Machine Learning



- Mobile Devices
- Social Media

- Blended Spaces
- Digital Integration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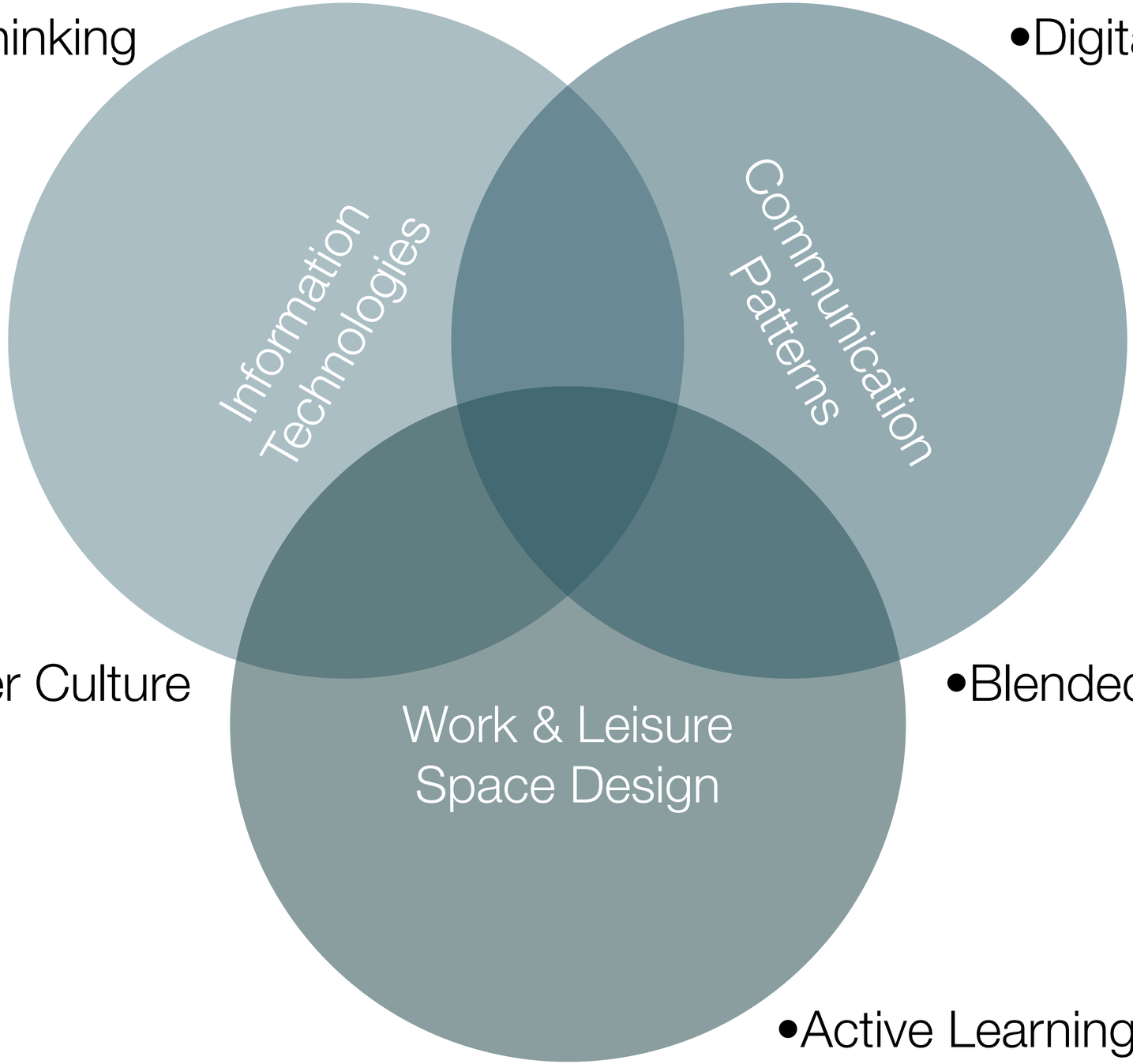
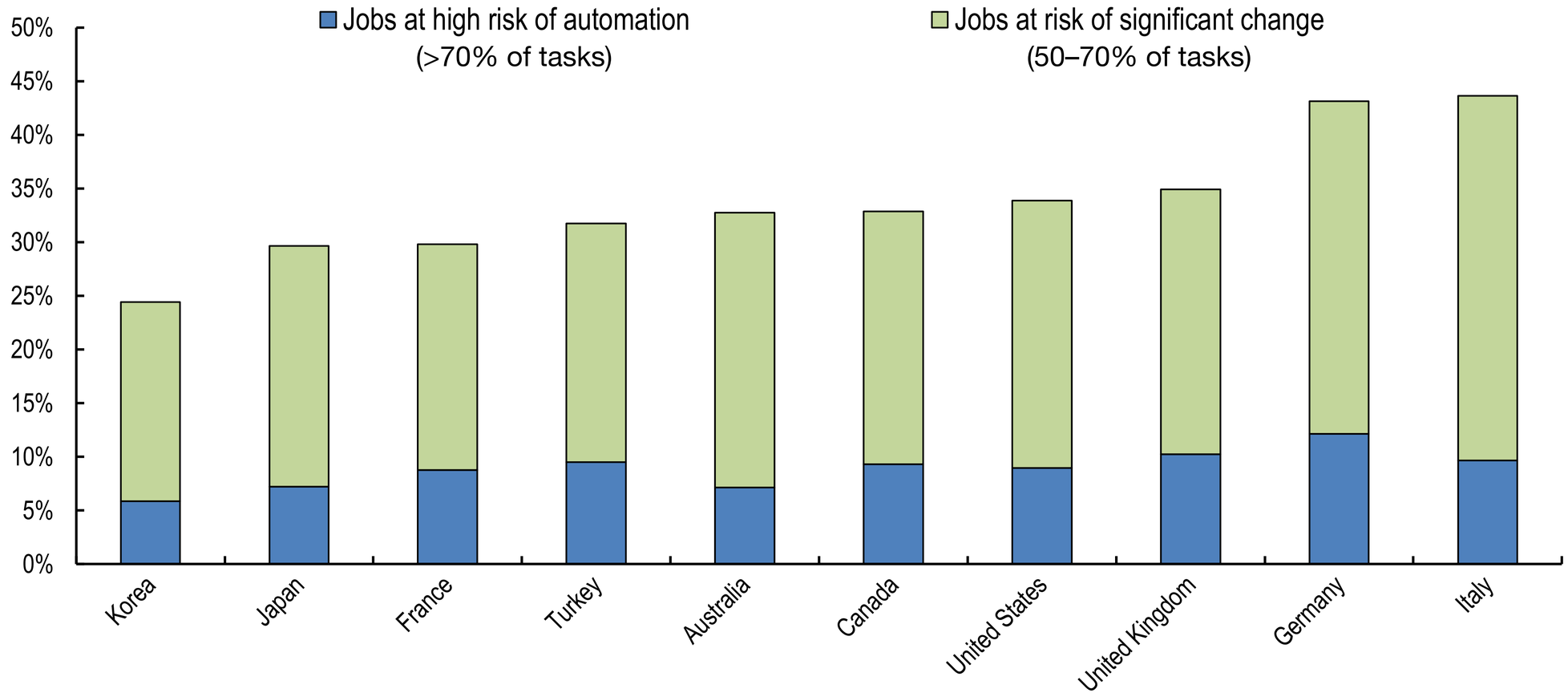
- Computational Thinking
- Digital Citizenship



- Maker Culture
- Blended Learning
- Active Learning Design

Advanced G20 Countries: Jobs at High Risk of Automation



Organisation for Economic Co-operation and Development (OECD), *Future of Work and Skills*. Paper presented at the 2nd Meeting of the G20 Employment Working Group, Hamburg, Germany. (2017)

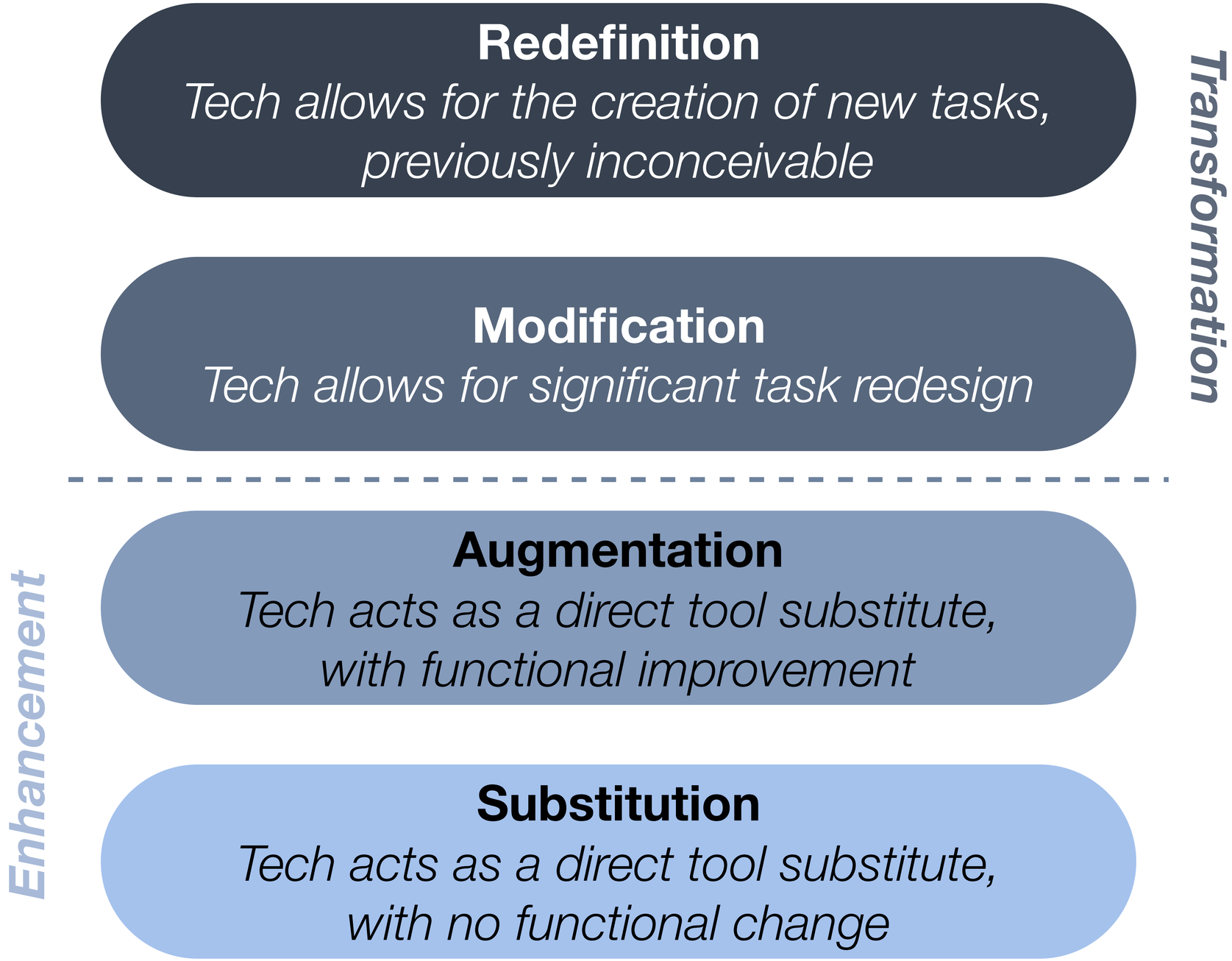
“*Gakushiryoku* - ability required for university graduates for an unpredictable era including the education, knowledge and experience to make correct decisions in the face of unexpected difficulties.”

MEXT - *Summary of Report: Towards a Qualitative Transformation of University Education for Building a New Future - Universities Fostering Lifelong Learning and the Ability to Think Independently* (2012)

Four Defining Characteristics of Action Research

- Practical Nature
- Change-Oriented
- Part of a Cyclical Process
- Teachers are Active Researchers and Participants

Martyn Denscombe. *The Good Research Guide: For small-scale social research projects (6th Edition).* McGraw-Hill Education (UK). (2017).



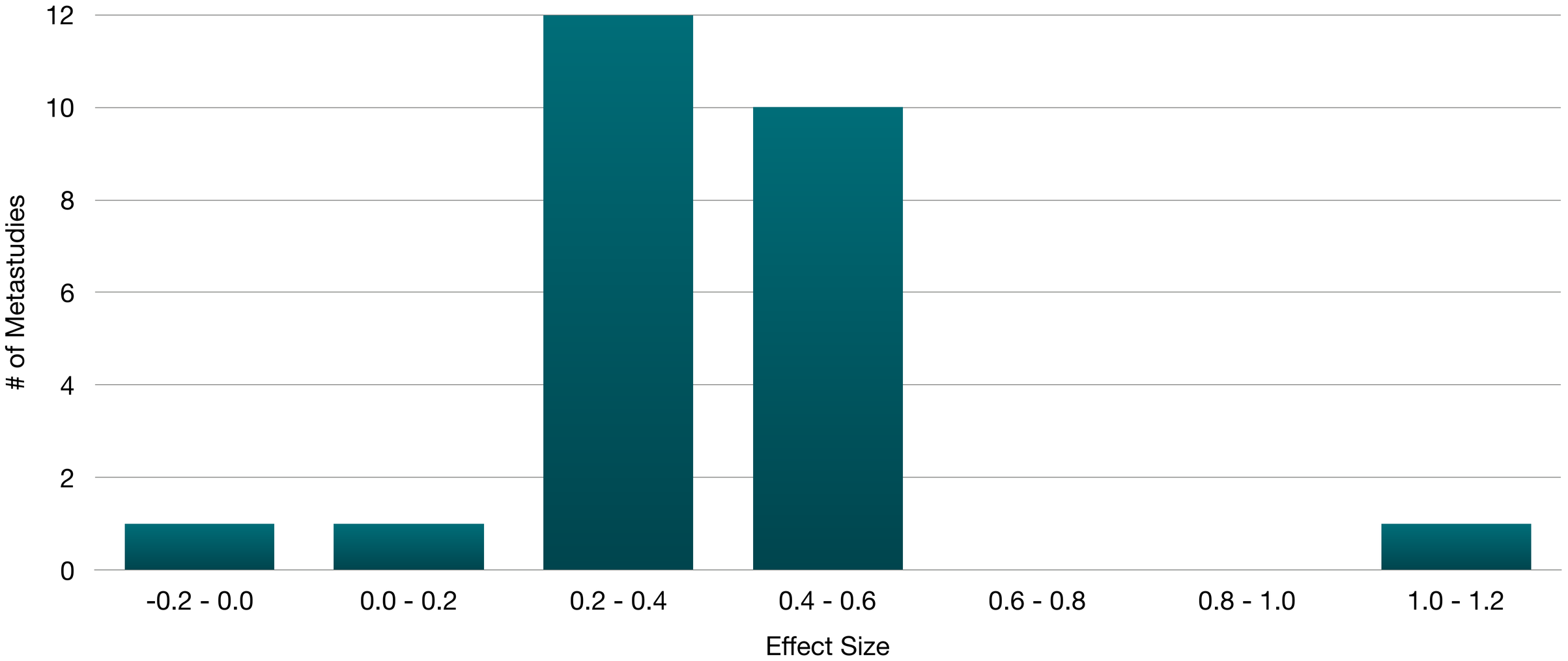
Ruben R. Puentedura, *As We May Teach: Educational Technology, From Theory Into Practice*. (2009)

Social	Mobility	Visualization	Storytelling	Gaming
200,000 years	70,000 years	40,000 years	17,000 years	8,000 years

Ruben R. Puentedura, “Technology In Education: The First 200,000 Years” *The NMC Perspective Series: Ideas that Matter*. NMC Summer Conference, 2012.

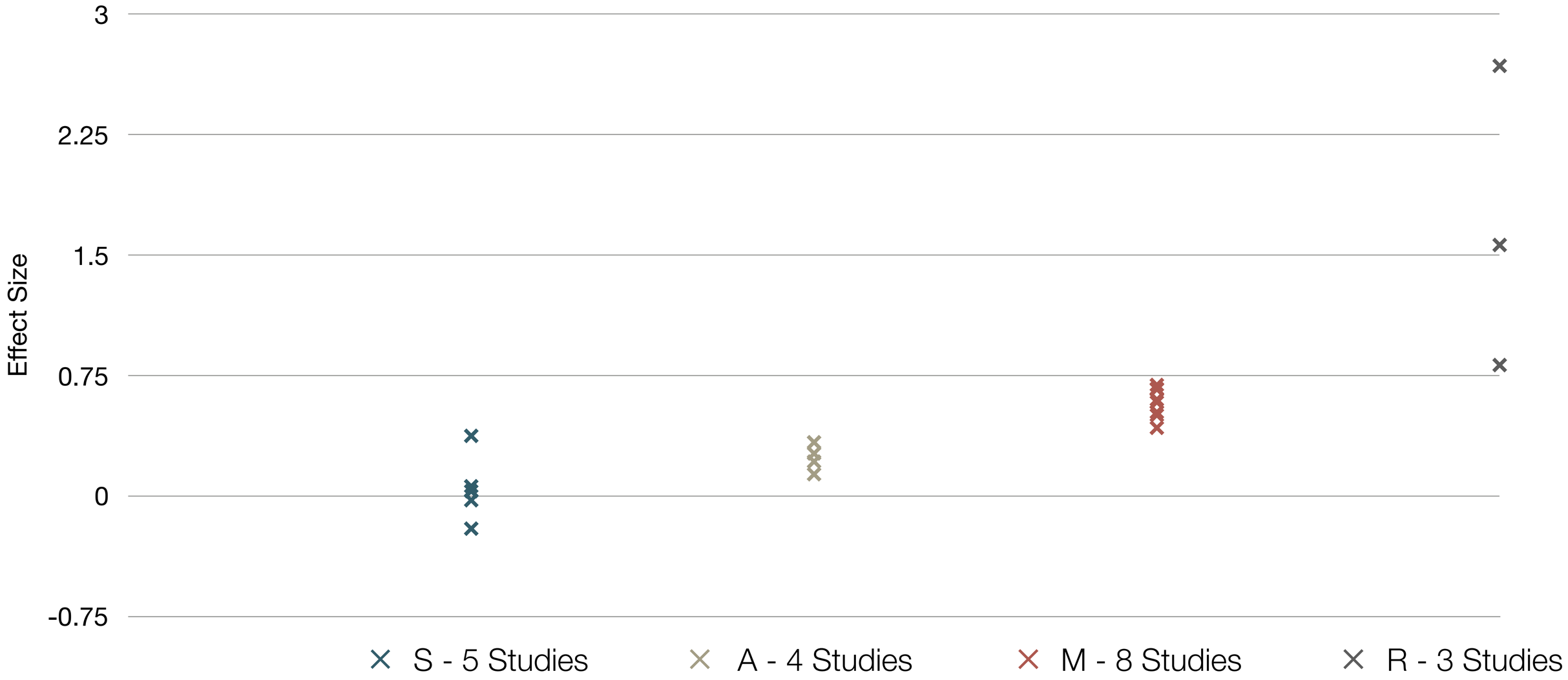
The EdTech Quintet – Associated Practices	
Social	Communication, Collaboration, Sharing
Mobility	Anytime, Anyplace Learning and Creation
Visualization	Making Abstract Concepts Tangible
Storytelling	Knowledge Integration and Transmission
Gaming	Feedback Loops and Formative Assessment

The Research: 1,097 Studies, 25 Metastudies, 19 Years



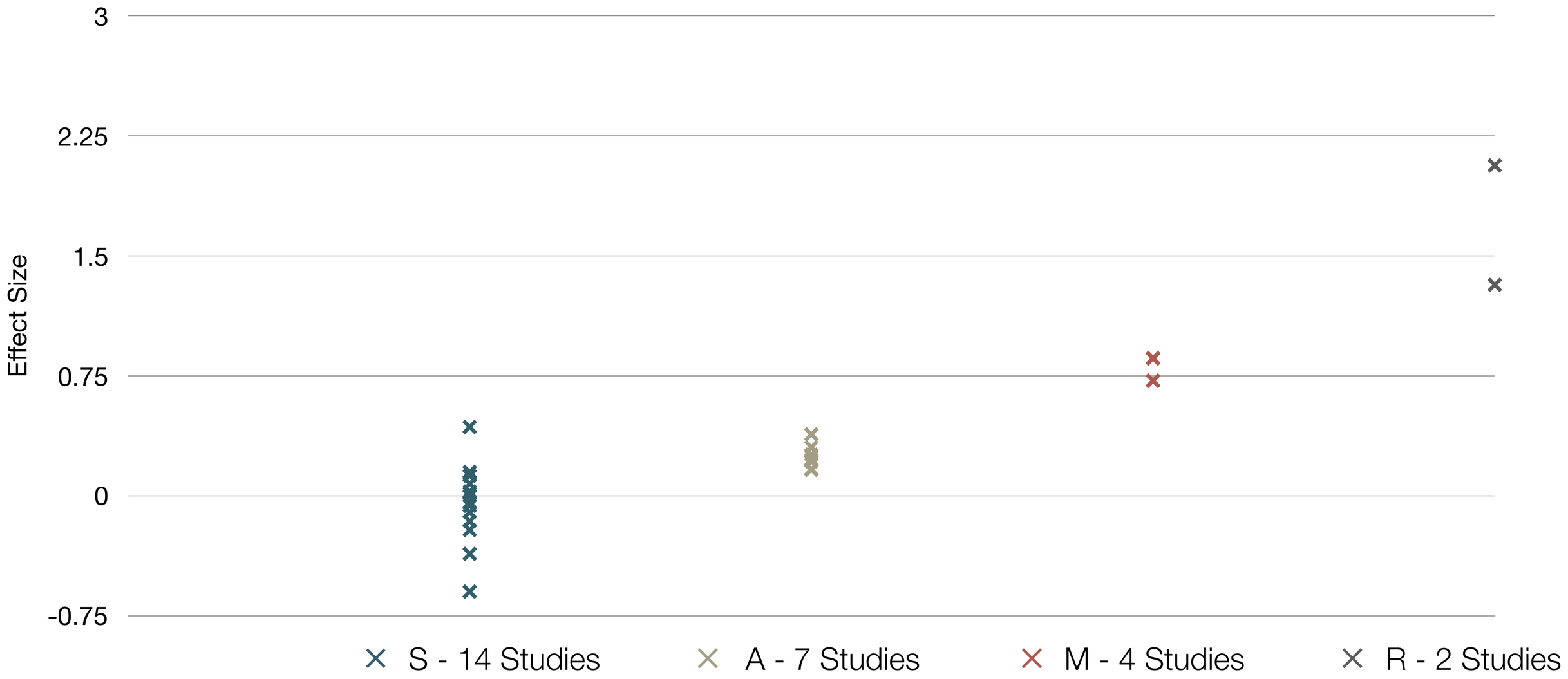
Tamim, Rana M., Robert M. Bernard, Eugene Borokhovski, Philip C. Abrami, and Richard F. Schmid. "What forty years of research says about the impact of technology on learning a second-order meta-analysis and validation study." *Review of Educational Research 81*, no. 1 (2011): 4-28.

SAMR and the Use of Technology to Enhance Reading Performance in Middle School



Pearson, P.D., Ferdig, R.E., Blomeyer Jr, R.L., & Moran, J. "The Effects of Technology on Reading Performance in the Middle-School Grades: A Meta-Analysis With Recommendations for Policy." *Learning Point Associates/North Central Regional Educational Laboratory (NCREL)* (2005).

SAMR and the Use of Tablets in Education



Tamim, R.M., Borokhovski, E., Pickup, D., Bernard, R.M. & El Saadi, L. “Tablets for Teaching and Learning: A Systematic Review and Meta-Analysis." *Commonwealth of Learning (COL)* (2015).

Redefinition *Tech allows for the creation of new tasks, previously inconceivable*	**Extended Thinking**
Modification *Tech allows for significant task redesign*	**Strategic Thinking**
Augmentation *Tech acts as a direct tool substitute, with functional improvement*	**Skills and Concepts**
Substitution *Tech acts as a direct tool substitute, with no functional change*	**Recall and Reproduction**

Webb, Norman L. *Depth-of-knowledge levels for four content areas*. (2002)

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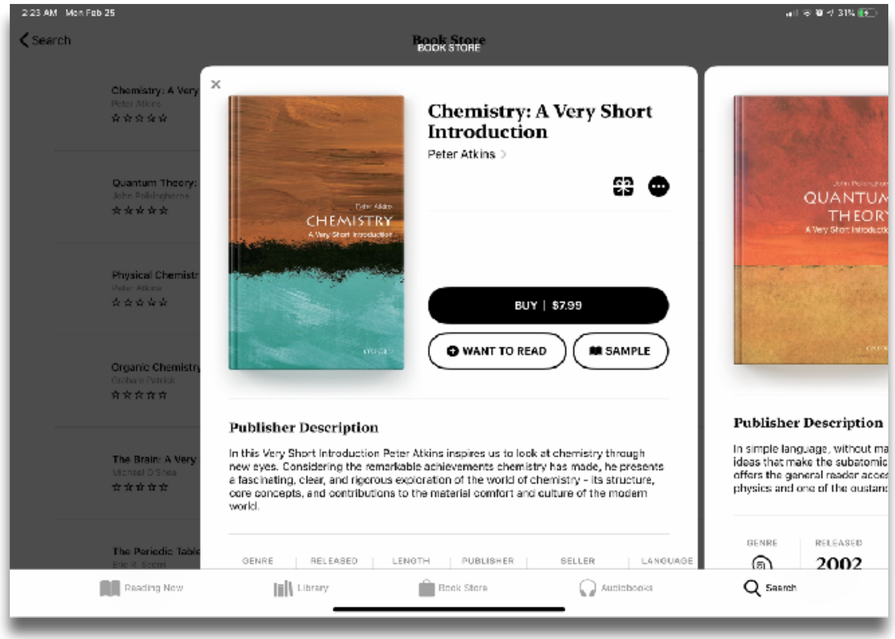
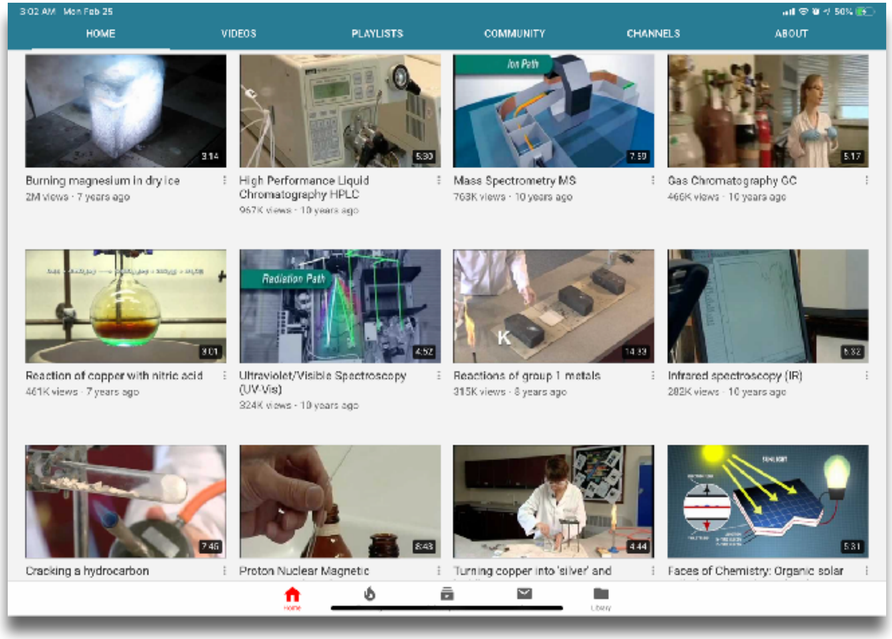
Recall and Reproduction





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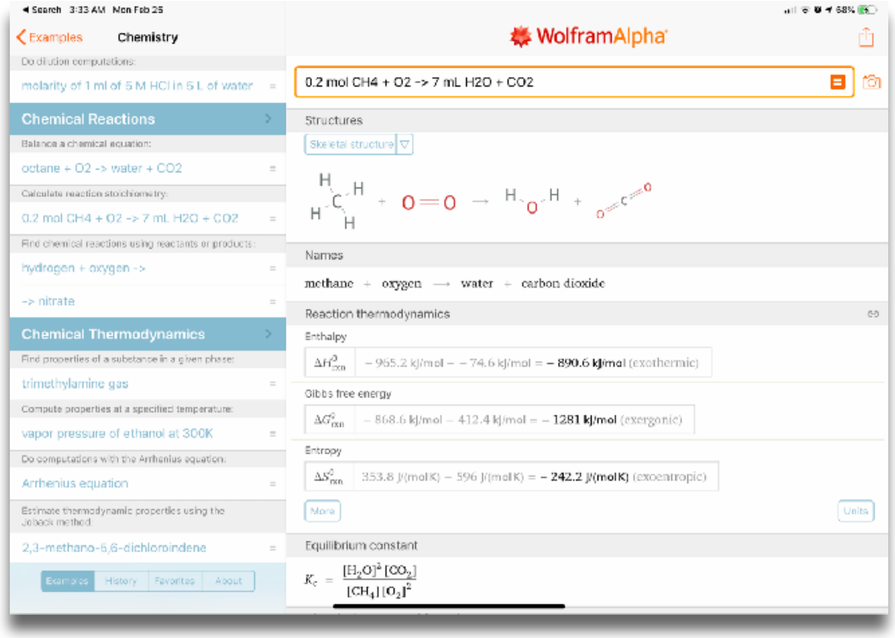
Skills and Concepts



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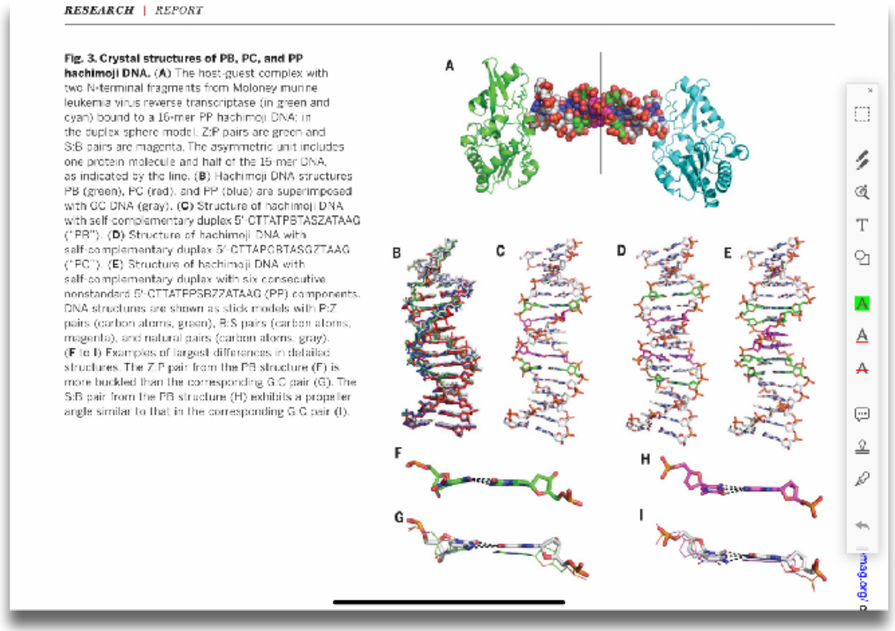
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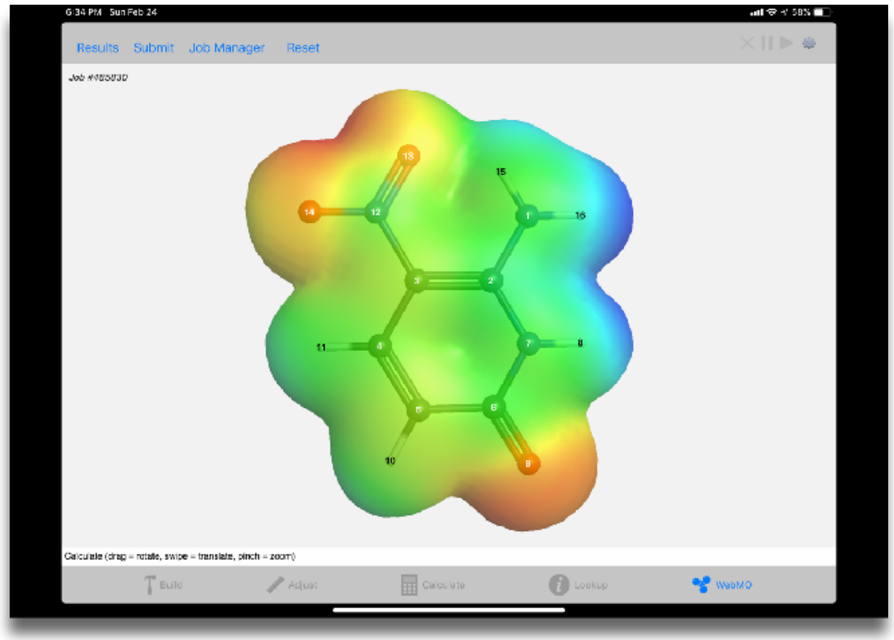
Fig. 3. Crystal structures of PB, PC, and PP hachimoji DNA. **(A)** The host-guest complex with two N-terminal fragments from Moloney murine leukemia virus reverse transcriptase (in green and cyan) bound to a 16-mer PP hachimoji DNA; in the duplex sphere model, Z:P pairs are green and S:B pairs are magenta. The asymmetric unit includes one protein molecule and half of the 15-mer DNA, as indicated by the line. **(B)** Hachimoji DNA structures PB (green), PC (red), and PP (blue) are superimposed with GC DNA (gray). **(C)** Structure of hachimoji DNA with self-complementary duplex 5′-CTTATPBTASZATAAG (“PB”). **(D)** Structure of hachimoji DNA with self-complementary duplex 5′-CTTAPCBTASGZTAAG (“PC”). **(E)** Structure of hachimoji DNA with self-complementary duplex with six consecutive nonstandard 5′-CTTATPPSBZZATAAG (PP) components. DNA structures are shown as stick models with P:Z pairs (carbon atoms, green), B:S pairs (carbon atoms, magenta), and natural pairs (carbon atoms, gray). **(F** to **I)** Examples of largest differences in duplex structures. The Z:P pair from the PB structure **(F)** is more buckled than the corresponding G:C pair (G). The S:B pair from the PB structure (H) exhibits a propeller angle similar to that in the corresponding G:C pair (I).



Hoshika, S., Leal, N. A., Kim, M.-J., Kim, M.-S., Karalkar, N. B., Kim, H.-J., … Benner, S. A. (2019). Hachimoji DNA and RNA: A genetic system with eight building blocks. *Science, 363(6429)*, 884

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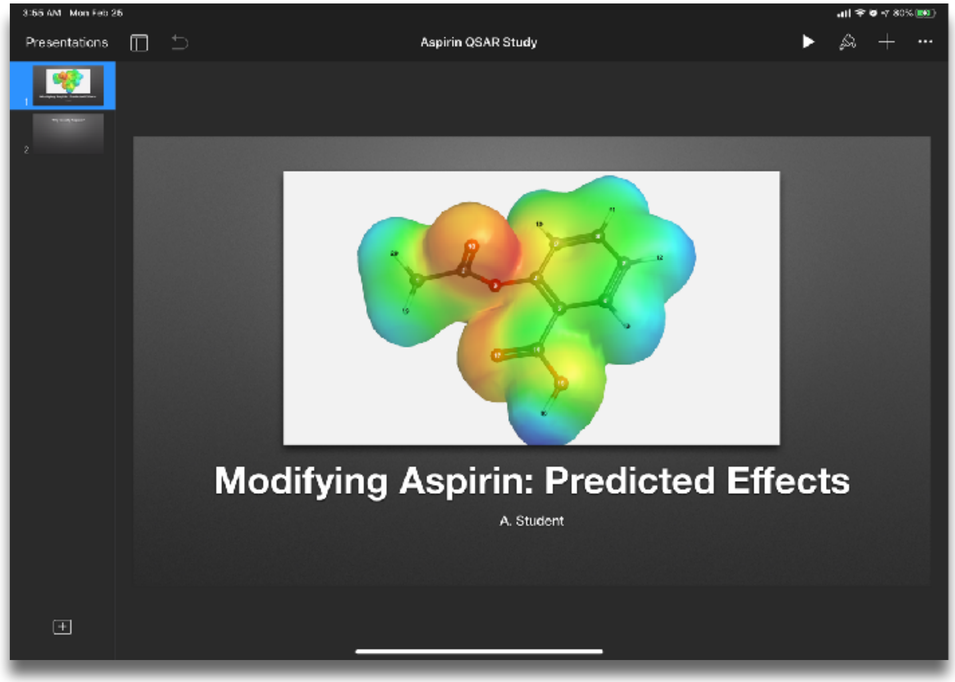

Competency / Concept	Model	Apply quantitative reasoning	Engage in argument from evidence	Engage in scientific inquiry and experimental design	Analyze and evaluate data	Appreciate and apply the interdisciplinary nature of science
Evolution						
Information Flow						
Structure and Function						
Pathways and transformations of matter and energy						
Systems						

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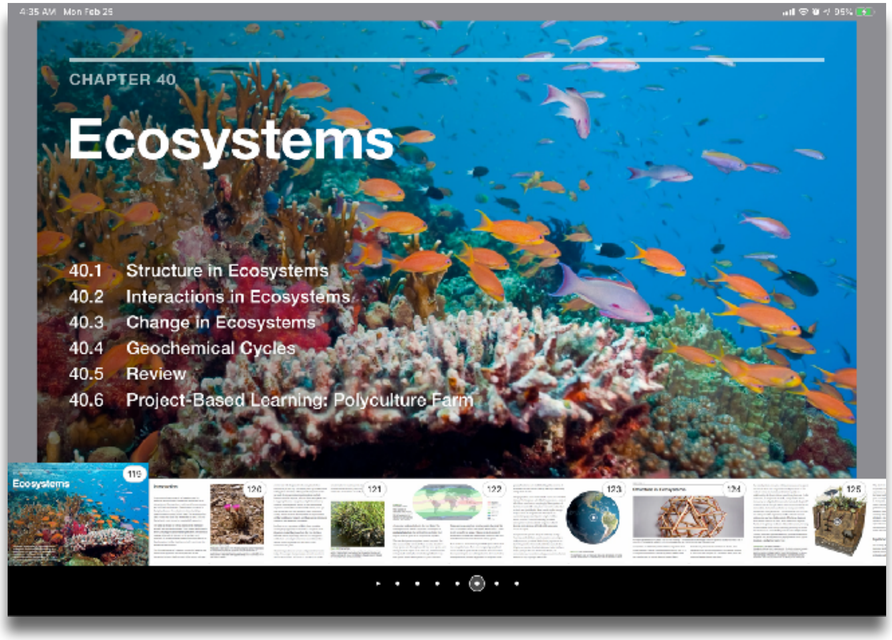

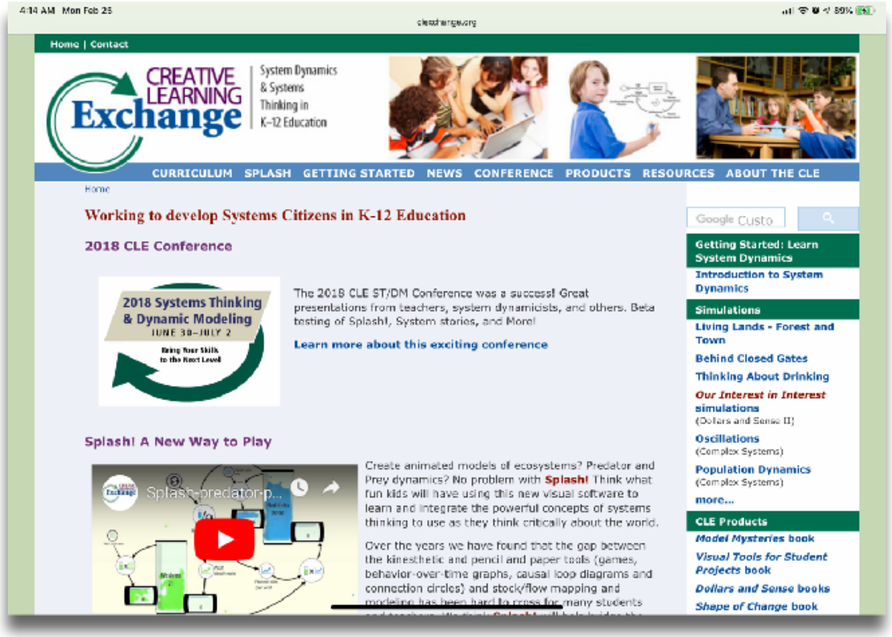

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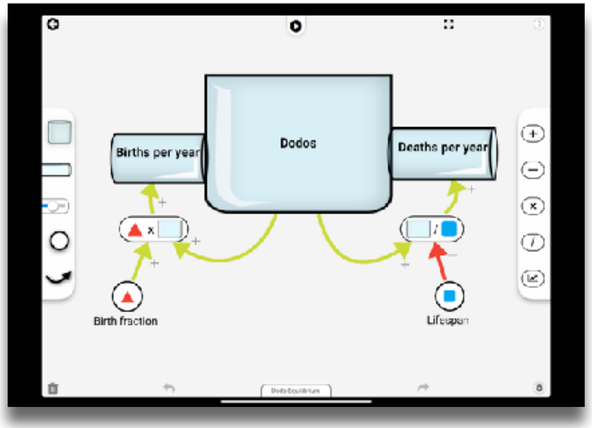

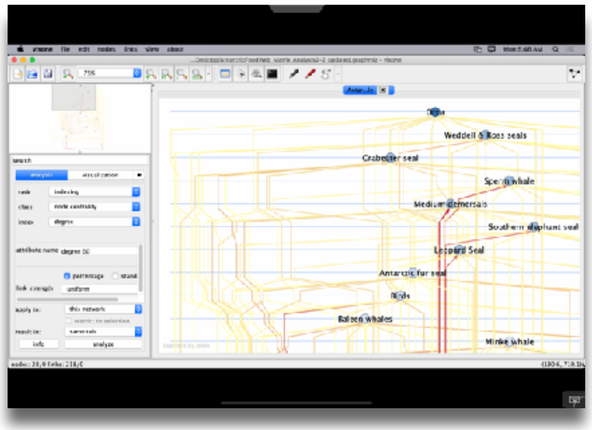

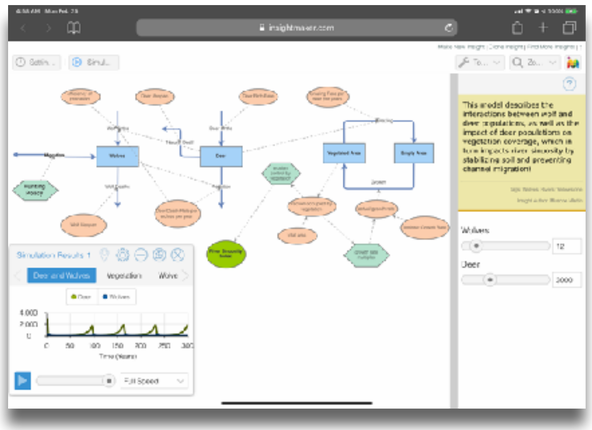

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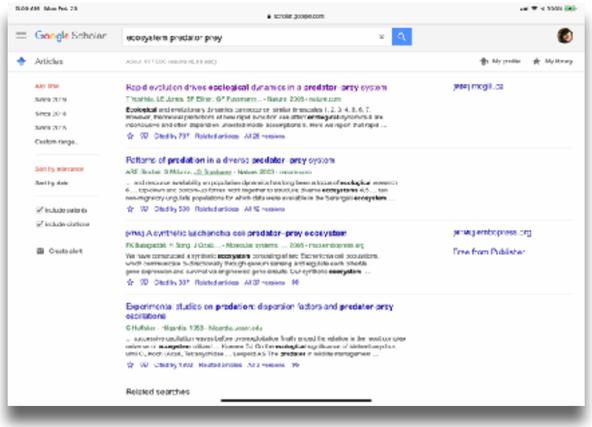

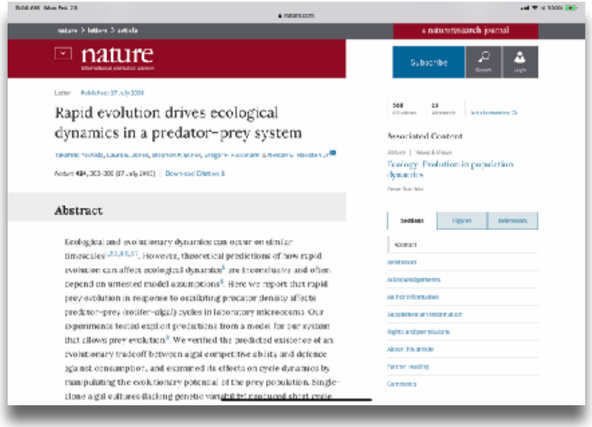

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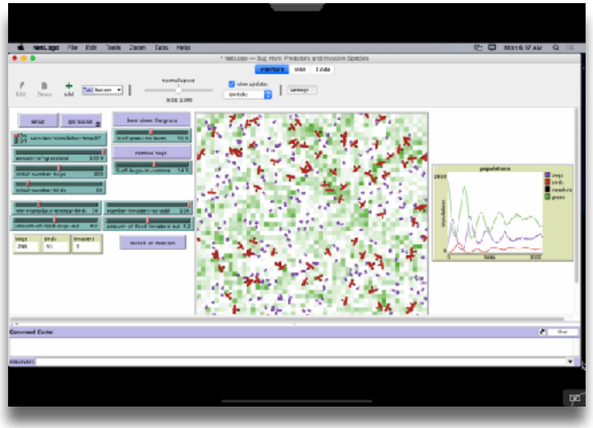

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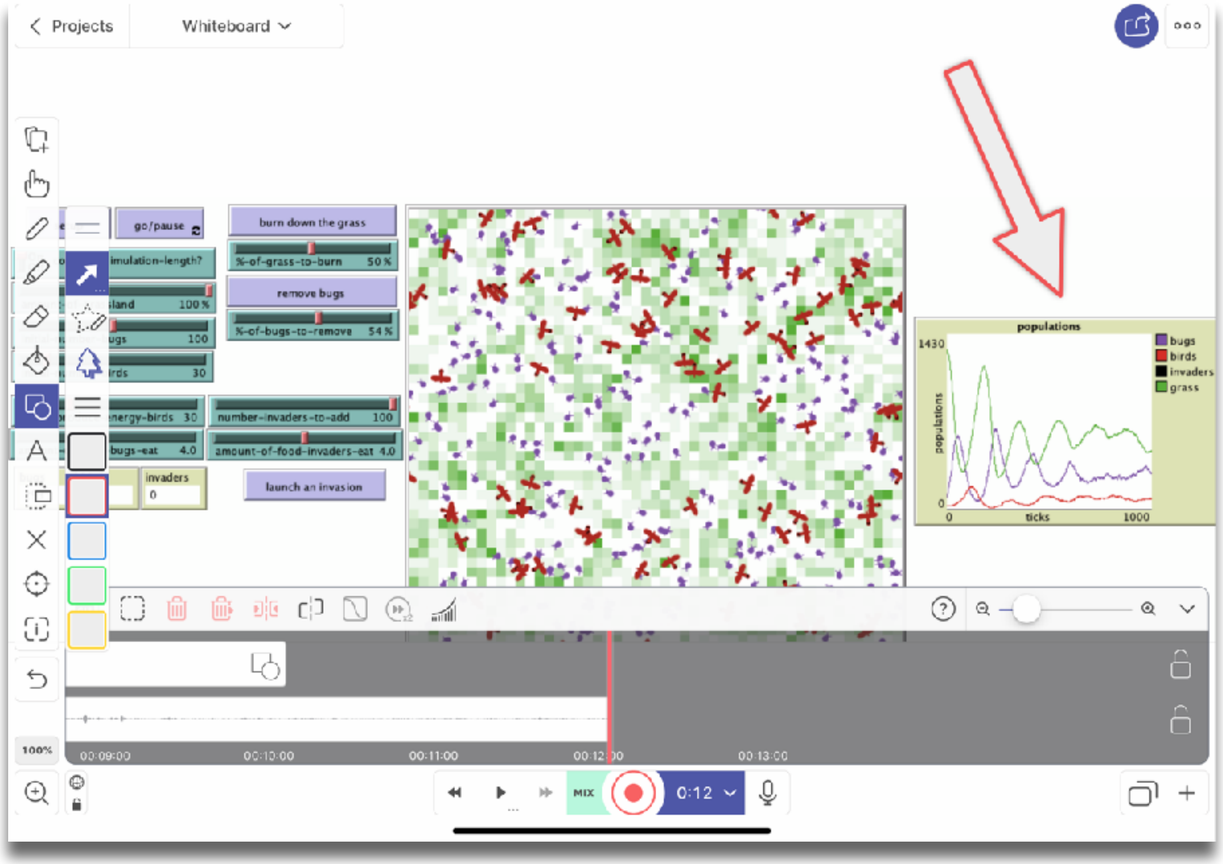
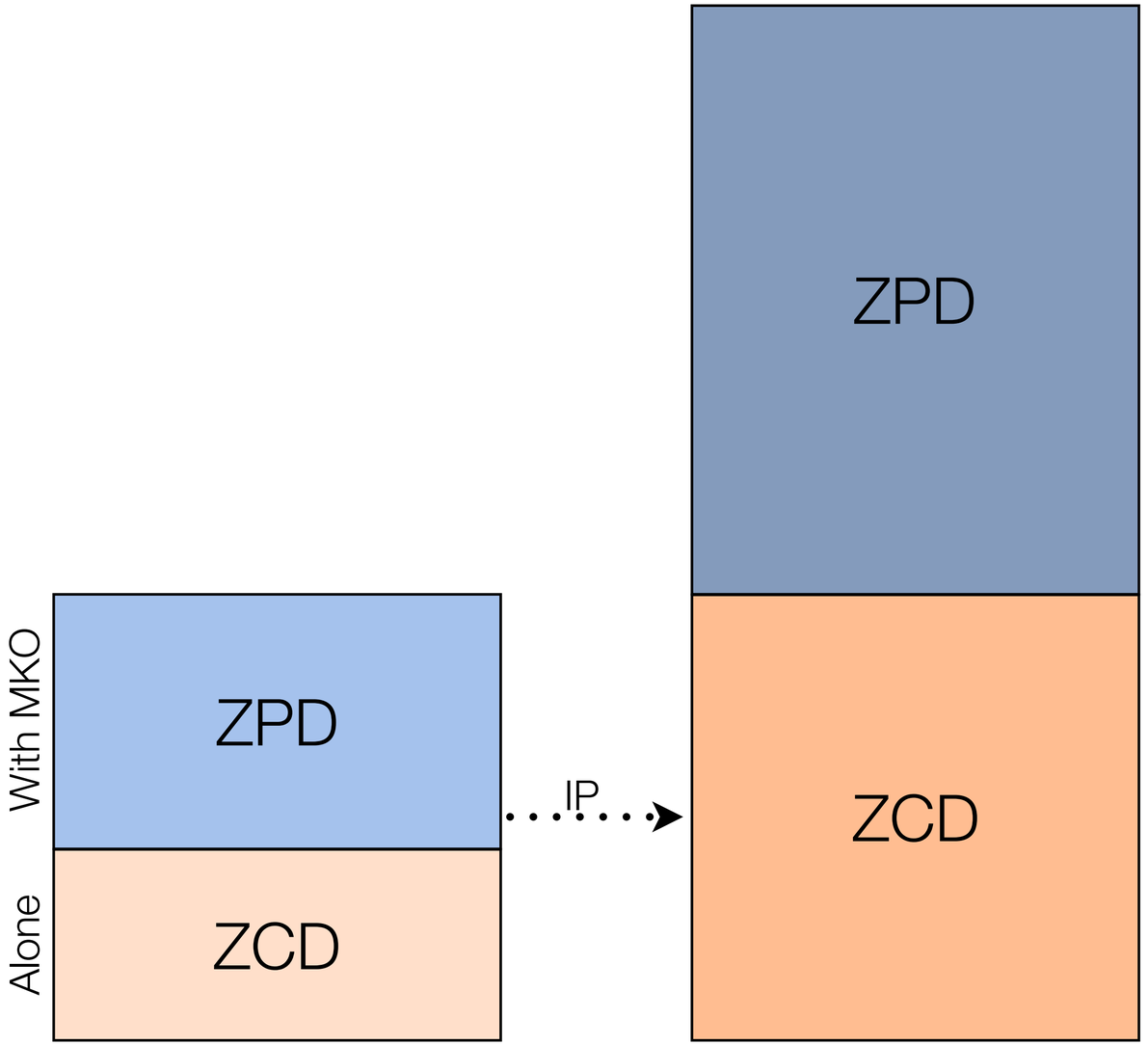
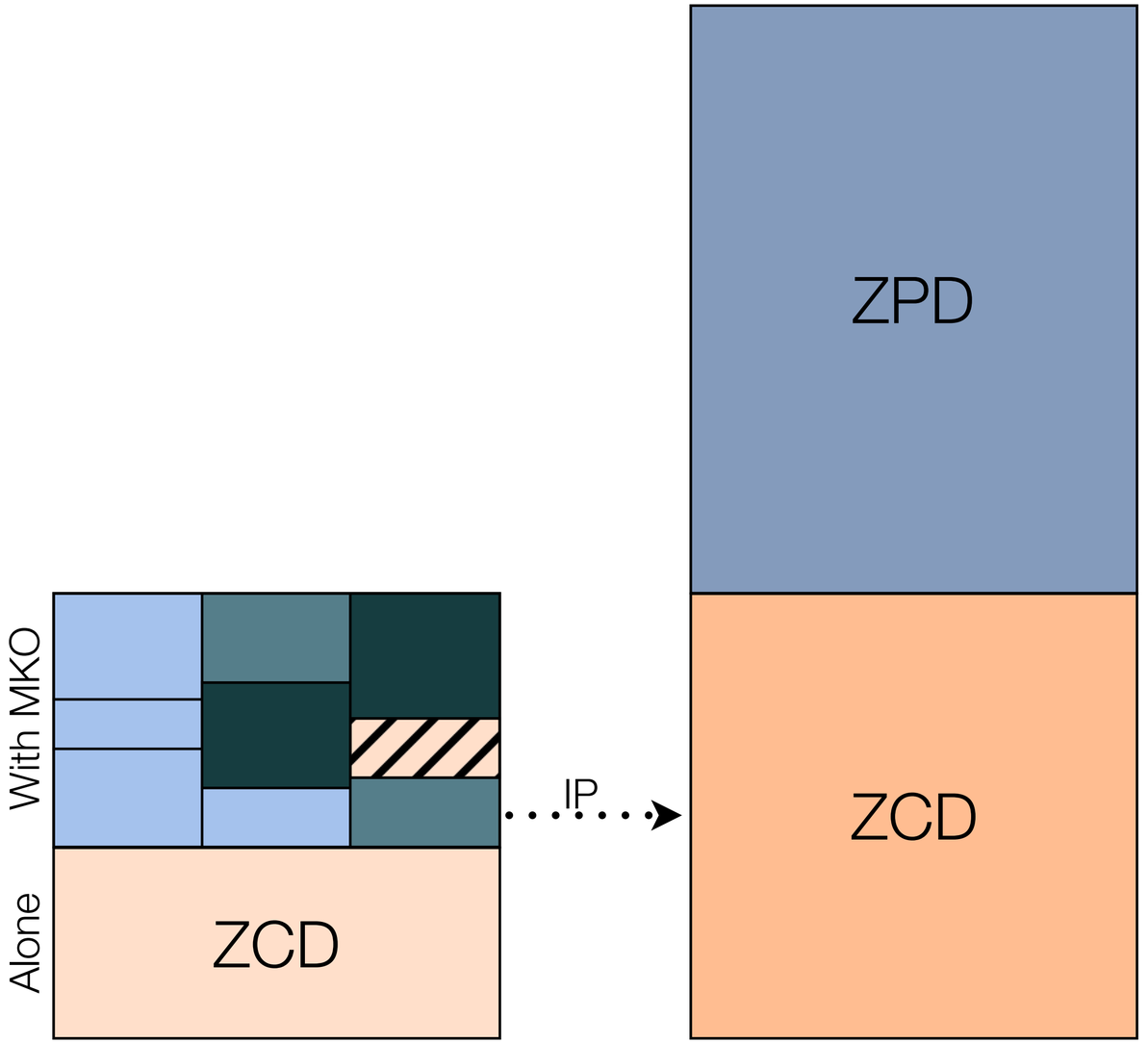




Lev Vygotsky, *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press. (1978)



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The EdTech Quintet – Associated Practices	
Social	Communication, Collaboration, Sharing
Mobility	Anytime, Anyplace Learning and Creation
Visualization	Making Abstract Concepts Tangible
Storytelling	Knowledge Integration and Transmission
Gaming	Feedback Loops and Formative Assessment

The EdTech Quintet – Associated Practices	
Social	Provides diversity to the ZPD
Mobility	Creates the context for the process
Visualization	Aids in segmenting ZPD, bridging gaps
Storytelling	Aids in the integration of the ZPD
Gaming	Provides frameworks for independent practice

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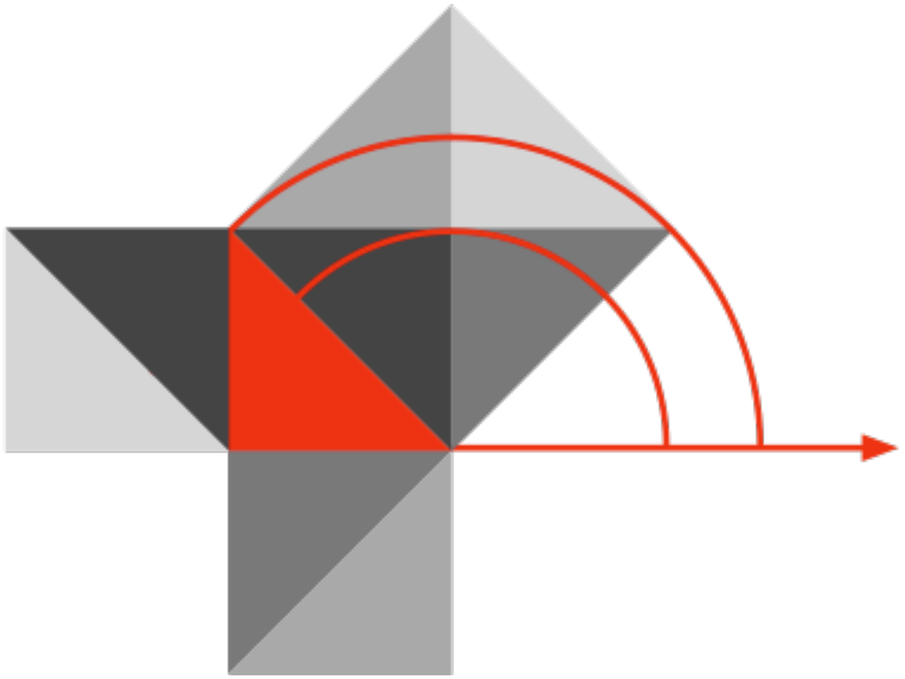

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