WORKSHOP MATERIALS (2022) · EDITED EDITION, 2026

Beyond Critical Thinking and Creativity: Human Adaptive Reflexive Agile Thinking (HARAT) using different combinatoric neural network architectures for supporting human decision optimization when working with artificial intelligence (AI) in education

Zafrullah Khan, Ed.D.

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LIGHTLY EDITED FOR SPELLING, GRAMMAR AND LAYOUT

Abstract

Human Intelligence (HI) is the most powerful resource on the planet. We spend enormous amounts of money on our education system to develop this resource. However, there are some misunderstandings with how people view this valuable resource, and its functionality when working with Artificial Intelligence (AI). It is HI that sets us apart from machines. We instinctively know what cannot be programmed, namely creativity, ingenuity, and empathy. The more challenging task of teaching critical thinking is more about facilitating dialogue than instruction. We can employ critical thinking techniques, but critical thinking draws on each person's unique perspective. This presentation and paper explore the future of human intelligence as related to artificial intelligence.

The human mind and artificial intelligence can achieve better results when collaborating with a shared purpose. The willful weaving of the elements and principles of creative and critical thinking with artificial intelligence will produce unique useful interesting concepts and ideas for immediate application to benefit both systems. This union of a human mind and AI can achieve a greater effect than either would have achieved on its own. The combination of human intelligence and AI creates unique ideas that are both practical and exciting. We need to think deeply and seriously about what future we envision and value from this theoretical collaborative intersection of both systems. Human learning architectures based on neural networks will be explored with the purpose of advancing predictability and control thereby optimizing human decision-making skills. Critical thinking will never be fully automated because critical thinking draws on the unique perspectives of the one being critical. AI is limited to the data and information that is programmed and it cannot think from a real person's unique perspective. Human Intelligence is the foundation of creativity. Artificial Intelligence will be the driver of critical thinking.

Workshop description

HARAT espouses a combined HI (Human Intelligence) and AI (Artificial Intelligence) synergistic response to recursive iterative feedback loops generated by both learning systems that will optimize human decision-making skills for leading innovation and creative thinking. HI and AI will require humans to shift our mindset to acquiring a different toolset to solve problems while dealing with complex realities using the highest forms of reasoning in education.

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1 Introduction

Artificial Intelligence (AI) is here. The disruptive effects and infiltration of AI happening right now make us all wary that it will soon replace the work done by humans and perhaps make our thinking skills less useful in the future of Strong AI (human-like AI). In embracing this new phenomenon, it will become incumbent upon humans to quickly adapt through strategic entanglement with AI's deep learning neural networks in unconventional ways. This paper will explore novel ways of integrating the interplay of both neural architectural systems for the greater good of humankind. Redesigning present human thinking in synchrony with AI will require many iterations using different human combinatorial neural input architectures that will work in tandem with continuous real-time AI deep neural network outputs. This will require modeling of 'fluid' feedforward thinking that will go well beyond critical thinking mastery.

This paper also makes an argument for the need of Human Expert Feature Engineers (HEPE) in the future who will be knowledgeable about applying specialized hyperparameter feature extraction quantitative and qualitative techniques that effectively and efficiently propagate inputs and outputs through the proliferation of various neural architectural frameworks in both HI and AI systems. Doing so will elevate human intellectual competence while managing our emotions and responding to aversive experiences in the age of AI. The human mind and AI can achieve better results when collaborating with a shared purpose. The willful weaving of the elements and principles of creative and critical thinking with AI will produce unique useful interesting concepts and ideas for immediate application to neural networks for data harmonizing, data enrichment, and predictive modeling.

2 Critical and creative thinking

Creative thinking is what will elevate human intellectual competence to produce unique concepts. Critical thinking is what will advise us how to use the concepts with care. Artificial Intelligence will enhance both. Human thinking is converging with AI. This convergence can produce new realms of concepts, ideas, philosophies, and moralities that are both creative and critical. Animated by a common human purpose, effective collaboration can lead to the emergence of a new kind of functionality. This will make it possible to influence the course of future events strongly and predictably. Intellectual competence is like a pool of water in that it can be deepened.

In the future, AI will have a profound effect in all aspects of work, education and in our daily lives. However, this is not a reason to fear it. AI is a potentially very beneficial technology for humans if we think about how to deal with it. Imagine a device that reads, writes, and thinks at the speed of light. Imagine if this thinking machine held all knowledge, solved any

problem, and learned to solve problems it didn't even know it could solve. This is artificial intelligence. Artificial intelligence and machine learning is a field that tries to make machines capable of intelligent behavior. Intelligence refers to the capability to acquire and utilize knowledge and skills. Human intelligence vs artificial intelligence is a very deep and broad issue that can be discussed from many philosophical and humanistic perspectives.

In this paper I will try to explore the anthropocentric vs machine-centric aspects of this issue from a futurist-optimistic point of view. One can argue that intelligence is both biological hardware and software. Biological intelligence is an emergent phenomenon; hence it cannot be replicated by artificial means. We can say the human body is biomechanical hardware to support the software of the mind which supports intelligence.

3 Human intelligence and AI

The potential for human intelligence and artificial intelligence to achieve better results when working together is undeniable. Human intelligence and AI can be combined to create unique concepts that are useful, interesting, and relevant. The goal of the human mind is to make sense of the world around us, and to do so requires narrative. That narrative can be linear, following a logical sequence of steps, or it can be cyclical, involved in feedback loops. Or it can be both.

The intelligence explosion is a hypothesized growth in intelligence with its concomitant growth in capabilities that results from a recursive self-improvement or recursive intelligence amplification. The basic idea is that smarter minds can invent better tools to make themselves even smarter, which can lead to exponential growth. It is an idea that we humans will soon make ourselves more intelligent and use our enhanced intelligence to build better tools and make ourselves even more intelligent and so on, each level of boost making the next boost easier and quicker, like a chain reaction. What is important to keep in mind is that the methods and the heuristics we use to solve problems and make decisions sometimes interfere with our ability to understand what we're doing.

Machine intelligence will become increasingly embodied, embedded, distributed, situated, 'ambient' and pervasive. And it will grow more capable than the intelligence of humans alone. This hybrid AI-human cognitive ecology represents a very different model of human intelligence: cybernetic human intelligence. The overall goal of these efforts is to test and augment core human intelligence. A countervailing force will be the emergence of intelligent networks, with their own architecture and archival memory systems. Humans have always worked to augment our own mental faculties, but now we are handing over ever more responsibility to machines that can learn on their own. Our objective is to explore what

happens when the two intelligences supplement, compete or even merge, and whether that configuration can produce something greater than the sum of its human plus computer parts.

In this presentation, I'll briefly examine the evolving AI and consider possible ways for humans to adapt to it. It is a complex idea, so I will sketch a few of the key elements. Human intelligence, the capacity to learn and grow, is the most important resource on the planet. We spend extraordinary sums to develop it in our children, and in ourselves, when wisely used. But to make our best use of human intelligence in the 21st century, we need to overcome some serious misconceptions about what it is and what it does.

HI and AI are like balloons in that they need effort to realize their potential. Brains learn better when information is combined with many other pieces of information, not just one piece. Brains also learn better when little pieces of information are carefully adjusted to work together. Human intelligence is more valuable than Artificial Intelligence when it comes to reinforcement, because human beings can learn in a multitude of ways. This multiple learning is better than random information in its neural inputs. A computer is only as good as the data it is fed. Public concern about AI will diminish when human intelligence and artificial intelligence are aligned with the same goals: to solve local, national, and global problems. Human intelligence aligning with AI will help solve some of the major problems in the world. This will happen only after both learning systems align their goals. Artificial Intelligence highlights the distinction between creative and critical thinking. Creative thinking is what produces original ideas. Critical thinking is what judges the values of those ideas. They are both essential to human thought.

4 Human Adaptive Reflexive Agile Thinking (HARAT)

HARAT espouses a combined human-AI synergistic response to recursive iterative feedback loops generated by both learning systems. This presentation will discuss how critical thinking, HARAT, and AI can be fostered and leveraged in our communities and countries to solve problems and deal more effectively with complex realities, using the highest forms of reasoning (heuristics, deductive, inductive and abductive). Human intelligence (HI) coexisting with Artificial Intelligence (AI) can be potentially a win-win opportunity that could lead to the recursive feedback loops of self-improvement for both biological and computational systems, triggering intelligence alchemy of various combinatoric neural architectures for thought optimization and human decision making. This dialectical relationship between the systems will be shown to be a feasible merging of the key concepts embedded in the Theory of HARAT with AI deep learning neural networks.

5 Co-generative principles of teaching and learning with AI

1. The relationships and interactions among neural inputs are valued more than following steps and procedures in producing desired outcomes.
2. Optimizing a working solution for quick decision making is valued more than trying to understand the narrative of the problem.
3. Deliberate and purposeful dynamic responses to changes experienced in both learning systems are valued more than trying something new, following a goal plan or following standard operating procedures.
4. Providing learning reinforcement with continuous high-value weighted information for the immediate application is valued more than bits of random information neural inputs not thoroughly examined.
5. Iterative combinatoric hyperparameter fine-tuning and adjusting of neural architectures for neural network optimization is valued more than feeding in a single input into the neural network.

6 HARAT for responsive classrooms: workshop content

This section arranges the content of the workshop slides presented at the conference. Slide text is reproduced with light editing; diagrams are redrawn as vector figures without changes to their content.

6.1 Weak AI vs Strong AI

> *Those who will not reason*
> *Perish in the act;*
> *Those who will not act*
> *Perish for that reason.*
>
> Poem summarized, W. H. Auden (as quoted on the workshop slide)

Survival in a world of AI will require your best performance, high intellectual standards, and creative and critical thinking.

6.2 How can one become a critical thinker?

- By asking pertinent questions (of self as well as others);
- By assessing statements and arguments;
- By developing a sense of observation and curiosity;
- By becoming interested in finding new solutions;
- By examining beliefs, assumptions, and opinions and weighing them against truth;
- By developing a “thinker’s vocabulary”;

- By listening carefully to others, thinking about what they say, and giving feedback;
- By observing with an open mind;
- By making assertions based on sound logic and solid evidence;
- By sharing ideas with others;
- By becoming an open-minded listener and reader;
- By engaging in active reading and active listening!

6.3 What's the theory behind HARAT?

Vygotsky suggested that effective teaching should be geared towards a learner's 'zone of proximal development' (ZPD). Precision teaching encourages us to be very specific about the material used with the child, ensuring that it is within the ZPD.

Precision teaching also draws on Haring and Eaton's learning hierarchy, which shows us how new learning needs to be fluent before it can be maintained effectively.

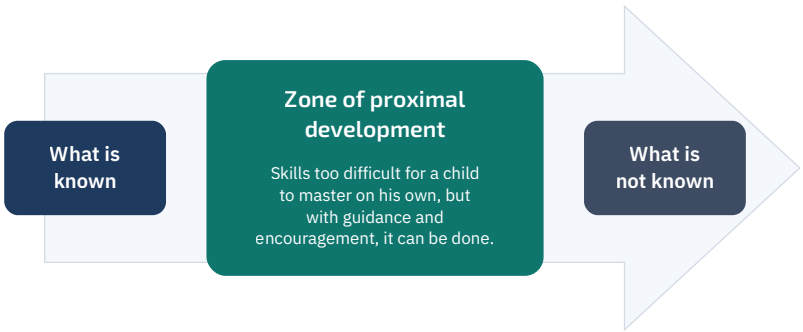


Figure 1. The zone of proximal development, between what is known and what is not known. Redrawn from the original workshop slide; wording as in the original (lightly edited).

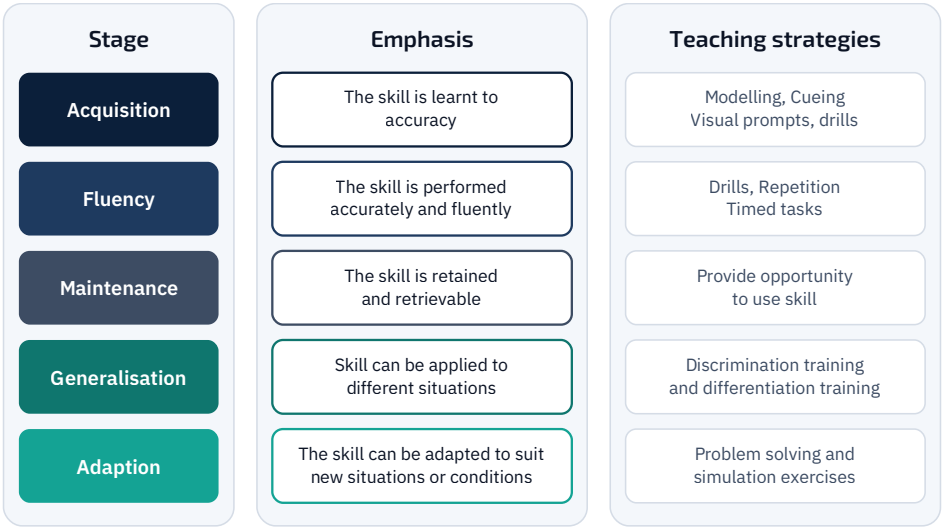


Figure 2. The learning hierarchy (Haring and Eaton 1978): stage, emphasis and teaching strategies. Redrawn from the original workshop slide; wording as in the original (lightly edited).

6.4 Stages of learning

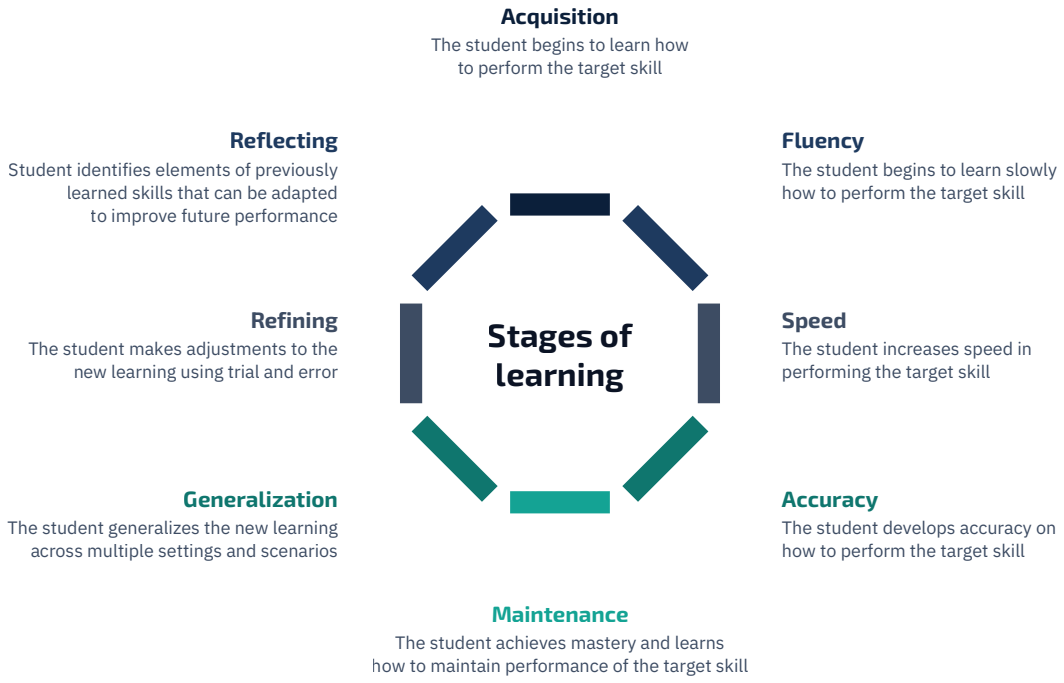


Figure 3. Stages of learning. Redrawn from the original workshop slide; wording as in the original (lightly edited).

6.5 Learning behaviors

Table 1. Learning behaviors (elements), from the workshop slide.

Element	Learning behavior
Imagine	Create scenarios for thinking and problem-solving using thought experiments.
Think	Process information for better decision making.
Feel	Create intense feelings of joy and wonder for learning. Seeing activities as personally meaningful.
Know	Convert content information into meaningful knowledge.
Understand	Deepen understanding of topic by making meaningful connections.
Do	Apply what was learned and find the task meaningfully challenging.
Review	Explain major concepts covered in the lesson in their own words.
Remember	Use a variety of learning strategies to recall and retrieve important facts.

6.6 High impact teaching

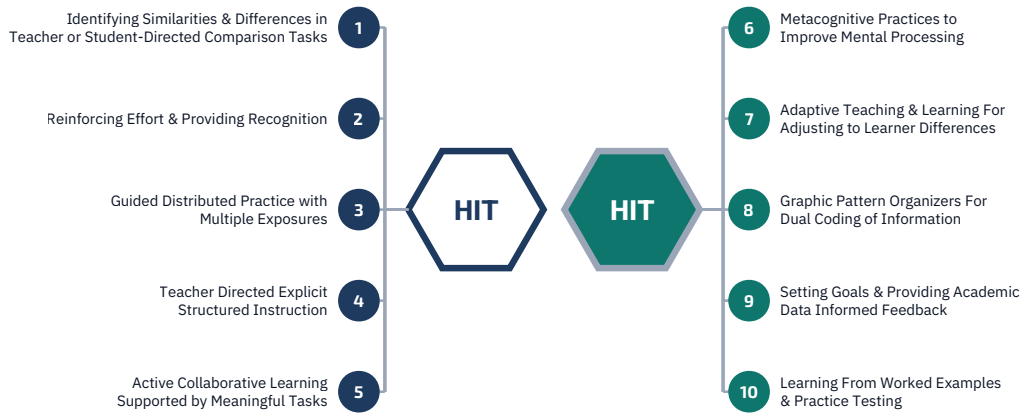


Figure 4. High impact teaching (HIT): ten evidence-based practices. Redrawn from the original workshop slide; wording as in the original (lightly edited).

6.7 Differentiation

Faulty teaching philosophy. Teaching is like bowling a ball down the middle and hoping to touch most of the students: fire hose style teaching.

Differentiation is not "mystery meat." It is common sense decisions teachers make when they adjust teaching and learning to make sure everyone arrives at the destination.

Table 2. Differentiation strategies presented in the workshop.

Strategy	Description
Alternate assignment	Assignments given to particular students or groups of students in lieu of the assignment given to the other members of the class. These assignments are designed to capitalize on student readiness levels, interests, or learning profiles.
Exit cards	Teacher distributes index cards to students a few minutes before the end of class. Students respond quickly to a specific prompt such as "What's the most important thing you learned today?" Exit cards provide a quick and easy method of assessing understanding.
Flexible grouping	Purposeful reordering of students into a variety of different groups in a short amount of time in order to ensure that all students work with a number of different students on a regular basis. Criteria for grouping (readiness, interest, learning profile, activity or task, content) will vary regularly as well.
Interest centers/ groups	Interest centers (often used with younger learners) and groups (often used with older learners) allow students choice in an area or areas of study. They allow students to choose a topic and can be motivating to students. If they are used as enrichment, they can allow the study of topics beyond the general curriculum. Groups address student readiness when they are differentiated by level of complexity and independence required.
Jigsawing	A type of collaborative work in which students read and examine a portion of a reading assignment and report what they've learned to the entire group. An effective way to vary content according to complexity or depth of content to match reading readiness levels. A great way to involve students in subject matter presented in text.
KWL charts	A pre-assessment tool consisting of three vertical columns. Students list in one column what they know about a topic or idea and in another column, what they want to know about the topic or idea. Then, after a lesson or series of lessons, they return to the chart to list in the third column what they learned about the topic or idea.
Orbital studies	Independent investigations, generally of three to six weeks, which "orbit" or revolve around some facet of the curriculum. Students select their own topics for orbitals and work with guidance and coaching from the teacher to develop more expertise on both the topic and on the process of becoming an independent investigator.
Personal agendas	A personalized list of tasks that a particular student must complete in a specified time; student agendas throughout a class will have similar and dissimilar elements on them.
Plus-minus-interesting charts	A device developed by DeBono in which students summarize their findings about a particular topic or idea by listing what's good about it, what's possibly negative about it, and what's interesting about it.

Strategy	Description
Product/project options	Students choose the way that they will provide evidence of learning from a variety of options. These options allow students to utilize their individual strengths and interests.
Pyramid activities	Any activity that begins with students working individually, progresses through pairs, groups of four, etc., and ends with the whole-class group. A good way to review material or to practice test-taking strategies. Students may begin by individually recording what they know and then add to or change their responses as they collaborate with other students.
Questioning strategies	Different types of questions are employed before, during, and after an activity, a lesson, or a unit of instruction to engage and challenge students to demonstrate their understanding from the knowledge level to the evaluation level. These questions allow students to clarify their thinking, increase their knowledge, and deepen their understanding.
Scaffolding	This refers to any support system that enables students to succeed with tasks they find genuinely challenging.
Tiered assignments	Teachers adjust the degree of difficulty for a particular assignment or task in order to meet the needs of students with varying levels of readiness, varying interests, and/or varying learner profiles. Assignments and products are designed to instruct and assess students on essential skills that are provided at different levels of complexity, abstractness, and open-endedness. The curricular content and objective(s) are the same, but the process and/or products are varied according to the student's level of readiness.
WebQuest	A programmed, self-contained activity on the internet that allows students to perform authentic, independent tasks while using the computer. WebQuests give individuals or small groups of learners the opportunity to use research, problem solving, and basic skills as they move through a process of finding out, drawing conclusions about, and developing a product related to a topic or question. Each WebQuest consists of the same five parts: introduction, task, process, resources, and evaluation rubric.

6.8 Co-creation: what it is, what it is not

Table 3. Co-creation: what it is, what it is not.

Co-creation is	Co-creation is not
Joint responsibility for planning, instruction delivery and classroom management	One teacher maintaining all planning and instruction
A component of a continuum of task design for students with varying needs	Having a “smaller” class in a large classroom
Carefully matched professionals to ensure success for all students	Two professionals providing instruction to a homogenous group of students
Both AI and instructor present in class every day	AI as an extra set of hands in the classroom
Both AI and instructor planning lessons to meet the needs of all learners	Trying to compete with lesson goals
Both AI and instructor being responsible for all students	AI working alone in decision optimization

6.9 ADKAR zones: it starts with you



Figure 5. ADKAR zones (awareness, desire, knowledge, ability, reinforcement), aligned with the stages pre-contemplation to maintenance and grouped into the enablement and engagement zones. Redrawn from the original workshop slide; wording as in the original (lightly edited).

6.10 Task design for HI and AI

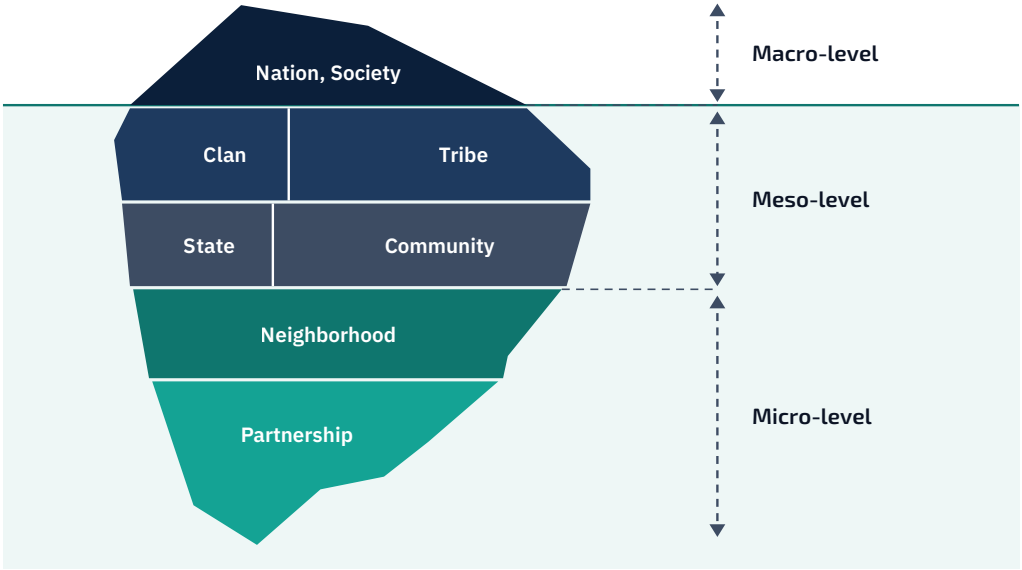


Figure 6. Iceberg task design analysis: macro-, meso- and micro-levels. Redrawn from the original workshop slide; wording as in the original (lightly edited).

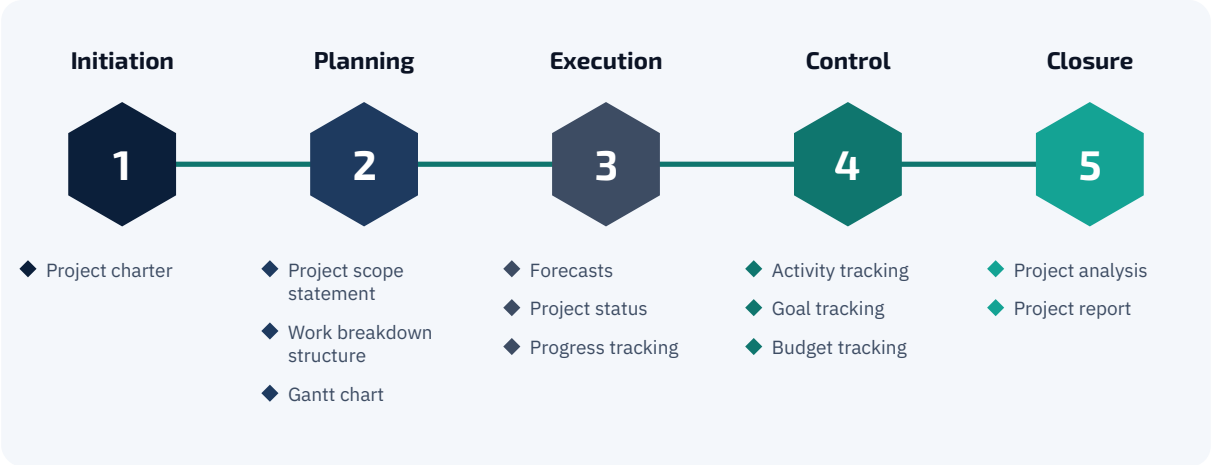


Figure 7. Task design builder, HI & AI: initiation, planning, execution, control and closure. Redrawn from the original workshop slide; wording as in the original (lightly edited).



Figure 8. Cognitive load in task design: risk from low to high. Redrawn from the original workshop slide; wording as in the original (lightly edited).



Figure 9. Risk management process: identify risk, assess risk, control risk, review controls. Redrawn from the original workshop slide; wording as in the original (lightly edited).

6.11 HARAT core values

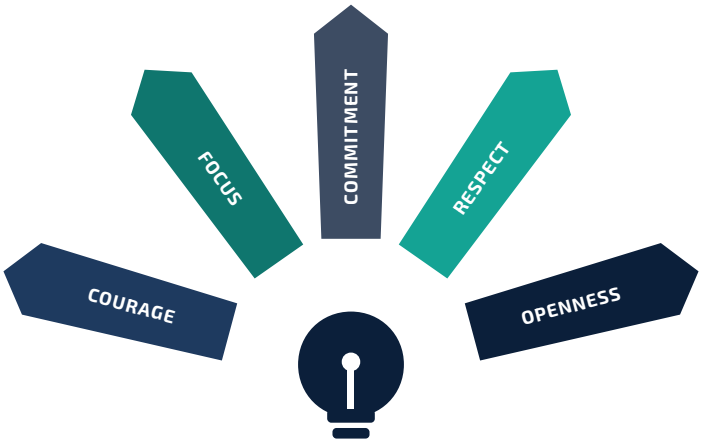


Figure 10. HARAT core values for teaching and learning excellence: courage, focus, commitment, respect and openness. Redrawn from the original workshop slide; wording as in the original (lightly edited).

7 Conclusion

AI will become less of a public concern after both learning systems align their motives and goals to solve major local, national, and global challenges, while at the same time making our lives better and building public trust. In retrospect, this undertaking will go beyond the

elements of critical thinking in making this partnership come to fruition. The interleaving of three key elements within the Theory of HARAT working in concert with AI will be modeled to accelerate biological critical and creative thinking.

The **adaptive** HI system will require the blending of one's mindset and skillset to achieve high probability target goals. The **reflexive** HI system will require being aware of one's thoughts and feelings during the cyclical nature of self-reinforcement in maintaining satisfactory equilibrium in acting with high emotional intelligence, morals, ethics and civic responsibility. And lastly, the **agile** HI system will require quick, precise, decisive thinking actions in responding proactively to volatile changes, especially during uncertain times.

> *"Everything we love about civilization is a product of intelligence, so amplifying our human intelligence with artificial intelligence has the potential of helping civilization flourish like never before – as long as we manage to keep the technology beneficial."*
>
> Max Tegmark, President of the Future of Life Institute (as quoted in the original proposal)

Note on this edition. This 2026 edition compiles the original 2021 conference proposal and the January 2022 workshop slides into paper form. No 2022 paper or proceedings version is reproduced here. Edits are limited to spelling, grammar and layout; no ideas, claims or sections were added, and figures were redrawn from the original slides. The original materials did not include a reference list, so none is reproduced here; names cited in the text (Vygotsky; Haring and Eaton, 1978; DeBono; W. H. Auden; Max Tegmark) appear as they did in the originals. Slides that consisted only of photographs or third-party images are not reproduced.