

How to Educate AI Thinking, AI Literacy, and AI Literature?

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Abstract: This paper focuses on how to AI Thinking, AI literacy, and AI literature. Currently, technology of the biggest impact on everywhere is AI and its related topics including ChatGPT. AI and ChatGPT is giving an influence on many areas, job pattern, workplace, and so on. This paper describes on how much importance to educate AI, AI literacy, and AI literature because the nature of working and the range of activities by AI have been changing.

As AI Thinking is that relevant to users of AI systems such as, choosing inputs, working with outputs, AI developers (design and implementation of AI technologies), AI related managers (determining the platforms and organizational practices AI for use), policymakers (government and organization), and data (data for the use of AI), it is quite important for students and higher education, professionals and the public people.

Because AI Thinking has a multi-purpose meaning about various aspects of AI user and it has a wide range of the management, the production, the training, and use of AI systems, it is absolutely needed to educate systematically to understand and learn with literature (this paper call as AI literature). Without introducing literature, the education of AI Thinking and AI literacy cannot implement. Through education, AI Thinking should provide guidance training as well as self-learning in professional, and structure and guidance for interdisciplinary AI teams (management and collaboration, evaluation) for industrial practice. AI Thinking should be recognized as an element of AI literacy, at least for practice-based education and professional experts. It is also important to distinguish, learn, and educate AI Thinking focused on AI practice, methodological, and context from more general-purpose AI literacy and more extended AI literature.

Keywords: AI and ChatGPT, AI Education, AI Thinking, AI literacy, AI Literature.

I. INTRODUCTION

AI application is wider and covers all domains even education system as well as technologies such as manufacturing, beauty, smart farm [20], fashion and manufacturing design, medical and public health policy, and so on. As current developing speed of AI and LLM and applications impact on many jobs and industrials [4], AI Thinking and AI literacy over application and AI is important to inform and educate literature and public people as well as even professionals and commercial designers of AI [2, 3]. Currently, AI impact on workforce, employment, and job replacement by AI [34-36] such as replacement by AI, creation by AI, and change of workspace by AI. All of these have to prepare and modify, again. The jobs of the traditional low-cost repeat work and industries can be significant displacement. That is, voice actress (or actor), investment analyzer (trader), secretary of office and reception of hotel, news getting and writer, data analysis, S/W engineer (coding), lawyer, graphic and fashion designer, beauty adviser, drivers, guiders, tele marketing, promotion, and so on are will be changing more and more [5].

The education area cannot avoid this impact. It is more serious because of non-professional in students. Commercial AI support study and analysis about students' personal characteristic and motivation through chatbots or other AI tools. AI also help design idea and creativity of students as well as experts.

Regardless human agreed or not, AI and its related technology is changing economic driving forces and job pattern [5, 26].

Currently, the impact of the ChatGPT on how to use it, how to have an application it, where to use it, after released Chat GPT in March 2023 (test version, Dec. 2022) is increasing more and more. Some reports (Brad D. Lund, 2023) mention the value of ChatGPT that its impact is over the impact of the steam engine of the 1700s of 2nd industrial revolution.

Of course, some experts, teacher or negative professor, and NGO have a negative thought about new technologies of ChatGPT. However, we cannot deny its creativity as well as AI and ChatGPT have productivity, ideas such as writing, drawing, analysis, music, and so on. It means AI jobs and productivity will be affected.

Historically, many technologies, such as fuzzy [6, 27], PSO [7, 28], and artificial immune network [8, 30] have been leading AI related technologies as optimization and inference function for classical AI [29, 30, 34]. They have been influencing research patterns and jobs. Now, we have the new revolution by AI and ChatGPT. It means the economic growth and the jobs patterns will be leading and improving through the combination of D.N.A (Data + Network + Artificial Intelligence) [9].

Herein, we must seriously have an idea what impact and how much on the economy and jobs in the future by ChatGPT and AI (or AI related technologies).

After opening ChatGPT from and Dec. 2022 (Chat3.5) and Mach 2023 (Chat4.0), several issues and worries about education, and social situations have been increasing. However, scientists and engineers have been developing an idea on how will create the positive application of ChatGPT.

Basically, ChatGPT has an ability with human-like writing and additionally Google released Bard trained DALL-E2 model, which can generate images on demand by huge amounts of data. MS also OpenAI developed another model LaMDA (it has two stages for trains like pre-training and fine-tuning with 1.56 trillion word, 137 billion parameters) for their completion against Google model (<https://www.searchenginejournal.com/how-google-lamda-works/442064/#close>).

MS announced Bing AI powered OpenAI GPT-4 [10] and they can use it on real time service. Also, many ventures and companies are trying to build new business by using these Chatbot technologies through conversation, communication, helper, and applications. That is, economic growth paradigms are changing because of this powerful ChatGPT and related Chatbot. The ChatGPT [11] is a big power engine for economic growth and job changing.

In case of workspace, the workforce is rapidly transforming by AI. Even they do not have a basic and powerful technology, application of AI has been developing continuously for target businesses, adaptation, competitiveness, and efficient, and so on regardless their job patterns and opinions. We also have to explore how AI is affecting the workforce. The automation by robot with AI (AI Robot) is transforming the workplace and impacting job roles across various industries as well as high-tech manufacturing [12, 13, 14]. Thanks to the advanced technologies, many manual and repetitive tasks already have been changed and they are leading economic pattern by efficiency and productivity.

Especially, human like AI robot will change dramatically workspace in different type. For example, manufacturing workers have to acquire new skills to operate and maintain machines and robots that are taking over manual tasks and the role of worker will be replaced by this human like robot. Additionally, AI application of high-tech manufacturing processes and human like robot will require and creating new job roles like data analysts, AI programmers, machine learning specialists, operation technology of human like robot. The workers of the future should absolutely be required a mix of technical skills, creativity, and adaptability to leverage the power of automation and AI effectively.

As AI continues to transform the job and employment patterns, individuals need to study or educate to obtain competitiveness in their works through contents such as data analytics, machine learning, and programming. Another way to adapt is to learn how to work with AI tools and technologies and collaborating with AI systems to achieve better results.

According to the report of the WEF (World Economic Forum) published in 2025, AI will have displaced 75 million jobs globally, but will have created 133 million new jobs [15-19]. This means that there will job be displaced significantly in everywhere. The requirement of the ethics and literacy about AI and ChatGPT will strongly be needed as AI Thinking. The relation and education among AI Thinking, AI literacy, and literature will be needed to educate systematically.

The first aim of his paper aims is to provide question on how we have to educate AI Thinking and AI literacy. To do that, this paper reviews impacting on job through analyzing and reviewing reports and papers. The second purpose is to design how we should educate for AI Thinking and AI literacy. AI Thinking and AI literacy is not only technologies and AI engineering domain but it should strongly include literature domain. The current situation of AI including ChatGPT is extending all domains of human being's life [20-15]. Therefore, the role of literature is increasing more and more, and now it is limited to cover AI Thinking and AI literacy as alone only technology and engineering. How we have to introduce into your education system for the young generation's job [29-41]. It is very important to understand and decide on how and what we have to teach and learn because of current confusion paradigm of AI.

II. LITERATURE FOR AI THINKING

A. Philosophy (Minds, Thinking of Human)

It (mind) is one of the philosophical domains that thinks human's thoughts. Absolutely, it is different from neuron of the brain. But Laurent Dubreuil, professor of Romance [2] studies and comparative literature, says that "whatever your position about physicalism (or not), a mind is more than a brain. Mental operations are extended meaning beyond the nervous system (physical system) but also occur when we share language (physical tools).

Basically, neuroscientists seek physiological commonalities from the brain and characterize the principle of cognition. However, there is situation to create new ideas (Dubreuil says). Readers can understand some requires more than a strictly cognitive framework.

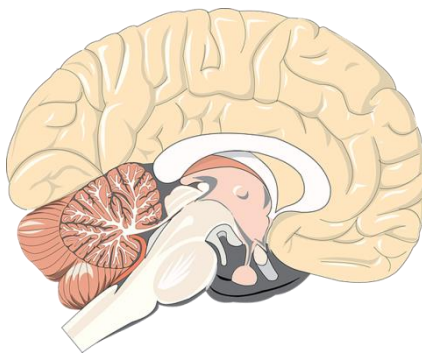


Fig. 1. Neuron.

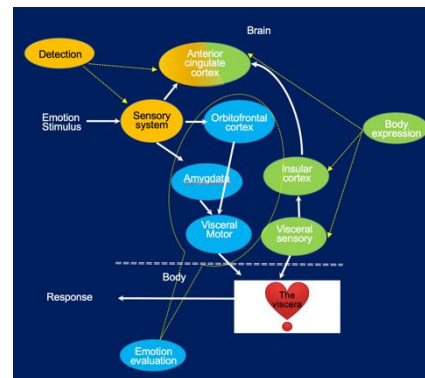


Fig. 2. Recognition track of cognitive and emotion in neuron.

Traditionally in Western Society, philosopher would say that the mind would be function of the mental domain. On the other hand, physicist would say that philosophers that mental phenomena have a physiological or a neurophysiological basis. We can say to develop AI like human: What? (Knowledge); How (Thought: Mind); Behavior (Reasoning of Human being); By what (Tool: Speaking, S/W); How to show (Use: Generating, Displaying Technology)

B. Philosophy and AI

The study of human intelligence began with no formal expression [42]. Initiate the idea of mind as a machine and its internal operations. How do humans think and act? The study of human reasoning and acting. Provides reasoning models for AI. Humans and other animals can be considered as information processing machines.

C. Psychology (Social) and AI

What is human different from animal? It is that humans think and act? To do that, they have reasoning capability and act [43]. AI follows this human model. The study for reasoning and acting of AI is required like human. The idea of humans can be considered as information processing model by reasoning.

D. Definition for AI Thinking and Knowledge by Literature

To understand on how to study AI thinking by literature, we must define about AI related words.

- **Common Sense:** Opinions of ordinary people
- **Learning:** Knowledge acquired by instruction or study for consequence of intelligent problem solving.
- **Experience:** Relates to what we've done and to knowledge and experience leads to expertise (Experience → Expert)
- **Intelligence:** Capacity to acquire and apply knowledge; thinking and reasoning; ability to understand and use language.
- **Memory:** Ability to store and retrieve relevant experience at will; part of intelligence
- **Data:** Unorganized and unprocessed facts; static; a set of discrete facts about events (Text, Number, Image, and etc.). It is a set of discrete facts about events
- **Information:** Aggregation of data that makes decision making easier. It becomes knowledge with questions like "what information should have for my final decision?"
- **Heuristic:** A rule of thumb accumulated by several years of experience. In mathematical optimization and computer science, heuristic (from Greek εὐρίσκω "I find, discover") is a technique designed for problem to solve more quickly against the classic methods are too slow for finding an exact or approximate solution.

- **Knowledge:** Understanding power gained through experience or study “know-how”. It is derived from information based on data; It can lead to a competitive advantage in business and study or personal strength.

E. Components of knowledge Representation system

- **Knowledge representation:** It is the process of structuring and organizing information in a manner that enables computers and systems to comprehend, reason, and make decisions [44]. That is, knowledge representation is the process of **encoding information** (Coding of Information) by several ways. Therefore, literature can develop knowledge representations and literature should help that an AI system can logically or others (Example, human being's thought, mind) comprehend and use knowledge representation as inference. Therefore, it has the role of converting information and ideas from the real world into a form that computers can use, analyze, and make conclusions. Basically, AI system **imitate** human cognitive functions including problem-solving, decision-making, and language comprehension thanks to this representation [2, 7, 24]. **Knowledge representation and reasoning** are used in AI to acquire knowledge for the smartest decision-making. It focuses on the behavior of an AI agent and make sure that it more or less behaves like human. The core technology of Artificial Intelligence (AI) is to express knowledge representation (KR). It (KR) is available to AI systems so they may learn, reason, and make decisions based on knowledge. To do that, we have to understand the complexities of knowledge representation in AI. Its represent ways is different depending on its different forms, the knowledge cycle, approaches, strategies, benefits, drawbacks, practical applications, difficulties, and future directions. Here, it is important to study literature for KR of AI. How to express? It processes for Thinking (Mind)-->Knowledge-->Language through S/W.

F. Real-World Applications of Knowledge Representation in AI

- AI's knowledge representation is used in a variety of fields and industries.
- **Expert Systems:** To simulate human competence and offer expert function of AI, knowledge representation techniques should be introduced. It is commonly utilized in industries like engineering, finance, and medicine where expertise in a certain topic is essential.
- **Natural Language Processing:** The AI systems should introduce knowledge representation to comprehend, decide, and human language, which is a key component of NLP applications. Applications for NLP include sentiment analysis, language translation, chatbots, and virtual assistants.
- **Robotics and autonomous systems:** Knowledge representation helps with perception, planning, & decision-making in these systems. It enables robots to comprehend their surroundings, gain knowledge from their past, and efficiently communicate with people.
- **Recommender Systems:** Recommender systems employ knowledge representation to model item features, comprehend user preferences, and generate tailored recommendations. They are widely utilized in content recommendation engines, music and video streaming platforms, and e-commerce.

G. What is the Good Knowledge Representation?

A good knowledge representation system should have these qualities:

- **Representational Adequacy:** It must be able to represent all types of knowledge so the AI understands them.;
- **Inferential Adequacy:** The system should be flexible, allowing it to adjust old knowledge to fit new information.;
- **Inferential Efficiency:** It should guide AI to make smart decisions quickly by pointing it in the right direction.;
- **Acquisitional Efficiency:** The system should easily learn new information, add it to its knowledge, and use it to work better. Artificial intelligence's foundation is knowledge representation, KR enables AI systems to comprehend, reason, and arrive at defensible decisions. Study face on all facets of knowledge representation in AI in this thorough guide; from its definition to its types; methodologies; strategies; benefits; applications; difficulties; and future directions. The potential of knowledge representation will be essential for creating intelligent systems that can solve difficult issues and supplement human abilities as AI develops.

Literature has an important role to play to explain inference and questions for AI thinking. Designers can approach the question of consciousness in very different ways. *Dubreuil's book, "The Intellectual Space,[45]" focuses on the distinction between thinking and thought. There is a process in our minds, he says, that bypasses cognitive structure, which he calls "intellection." His extensive research in experimental psychology, literature and philosophy led him to conclude that "we say more than we think; we think more than we say."*

Structural Knowledge: Many scientists, humanities, and literature researcher have been interesting on how language can express human's meaning and mind. However, language have been becoming a topic for cognitive science during the last 30 or so years as the importance of mind and as what you are thinking [46]. Currently, some are interesting as one of the most exciting ways of understanding how the mind works, which can provide the mind and the world interact [47].

“If you try and spell out in a scientific way what it is we’re doing, there are a lot of mysteries that pop up,” Starr says. “To build up a whole separate world and imagine the relations between different possible events in those worlds is computationally intensive. A lot of my work is looking at models developed in psychology and artificial intelligence and engaging them with philosophical and humanist questions.”

As the linguistic ability of the race is undoubtedly for creating comprehensive and a level of cultural product, language can therefore provide through fully understanding by collaborations across the humanities, the social, and natural environment (sciences). Basically, processing of language is so much scientific, using methods such as neuroimaging, eye-tracking, statistical learning experiments, psycholinguistic studies, and computational modeling. That is, the humanities offer key insights into the mind as well as language and writing abilities.

H. Making an AI mind motivation by Literature

How to motivate for AI thinking through the literature? Fig. 3 shows the component for AI thinking in this paper. Goal is what you are going to obtain through this AI thinking and formulation presents how to work by AI. Then you can develop tool and AI related technologies that you are going to develop for your work. Of course, in this step you have to include model, S/W, and computational methods. Fig. 4 illustrates relation between AI and knowledge to show effectively know representation by data.

Because literary text is a so complex expression system but designers should express AI thinking by this literature. Of course, it is difficult to develop tools in experiment or scientific logic to fully address. That is why designer should try to implement in many reasoning and other ways.

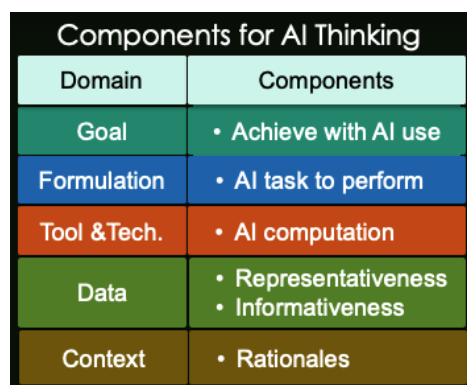


Fig. 3. Component for AI thinking.

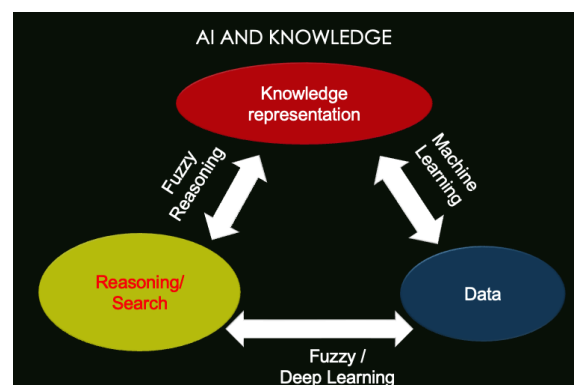


Fig. 4. AI and knowledge representation.

You can find eloquently to show AI thinking from routines, patterns, hypothesis rules and operations more than the conventional ways.

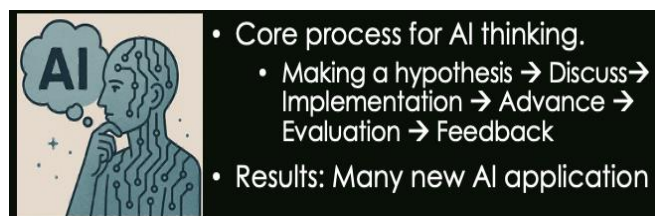


Fig. 5. Process for AI thinking.



Fig. 6. The final goal of AI thinking through data.

Ref [3] examines the mind of human by questions relating to perception, drawing on the fields of philosophy, vision science and the theory of probability to answer how exactly we learn from our visual experiences of the world.

Ref [3] human tend to think that perceptual experiences tell us about what the external world is like without being influenced by our own mind,” says Teng. “However, recent empirical research indicates that that’s not true: our beliefs, expectations and other mental states can causally influence what we experience.”

Ref. [4] investigates how presuppositions might affect perception and focus on the implications of any such influence for how we perceive the world, including art and even food.

Knowledge in AI can be divided into various types of knowledge, each method serves a particular function in the process of knowledge representation: Declarative Knowledge; Procedural Knowledge; Meta Knowledge, Heuristic Knowledge, and Structural Knowledge (Fig. 5). Fig. 6 shows the process of knowledge representation method.

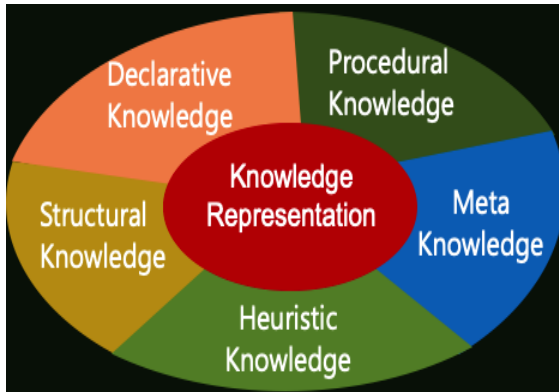


Fig. 5. Representation ways of knowledge.

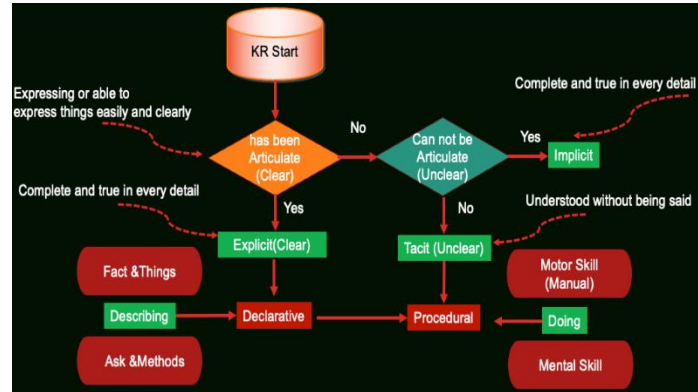


Fig.6. Process of knowledge representation.

I. Mind and Computer

Technological researchers have always been trying to explain the mind. Ref [48] John Locke described an infant's mind as a blank slate. Freud [49] compared the mind to hydraulic and electro-magnetic systems. Currently, the favorite comparison is relation between the mind and the computer [50]. This Ref. explains the mind's unique language-using abilities in terms of particular algorithms, data structures and computer architectures. This Ref. try to combine the traditional methods from logic and probability with the empirical ways from linguistics, psycholinguistics and brain imaging to show. "In cognitive science, the mind is viewed as a computer."

However, this situation has been changed from 2022 after the development of ChatGPT because there are many tools and applications as shown in Fig. 7. And job patterns will also be changed as shown in Fig. 8. Several analyzers and predictions already predict ChatGPT has impact over revolution of steam engine in 1700s when Murati (AI CTO of OpenAI) developed 2022, she will be the first innovatory person [51].



Phot: Murati.

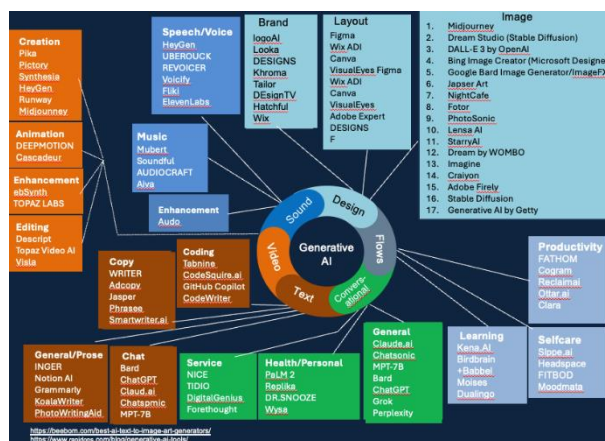


Fig. 7. Representation methods of several knowledge.

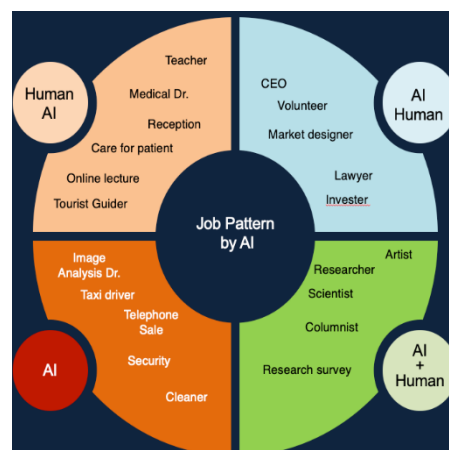


Fig.8. Job patterns by knowledge representation of AI.

ChatGPT has a strong capability: IQ test at 54 countries; GPT-3 IQ: 150 (99.9%); ChatGPT: IQ 147 (99.9%); GPT-3.5: USA bar Test, CPA, & US Medical test (2023. 1.18); ChatGPT: sentence B+ - A-; plagiarism id no problem; APA (American Psychological Association Test pass) of ChatGPT, when it was announced in 2022 (First version) by using these infra. (H/W super com and GPU (~10,000 GPUs and ~285,000 CPU cores); Price (MS OpenAI \$ 1 billion); Researchers (best data Dr. member from all the world); OpenAI pays Ilya Sutskever (leader of development) \$1.9 million in only 2016 and \$200 million 120 team members during first year, 2016; Data getting terms 12-18 month; learning terms 9-12 months for chatGPT first version [52].

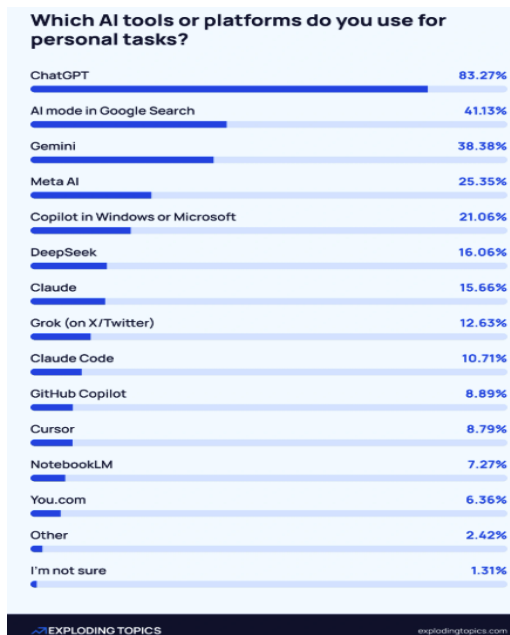


Fig. 9. The number of users of Generative AI.



Fig. 10. Subject for novel translation comparison [53].

However, we cannot image its capability and applications because many companies develop several different GPT and learns through many data and image almost after 10 years in 2025 as shown in Fig. 7 and 9 [54]. It means AI capabilities are so wide and has capability like creation (it is not like human but develop new one) using new data through fusion and combine data.

J. How Much Can Literature Useful in AI use and Development?

This paper tries to test to show how it is useful in AI for our life. It is the comparison of translation capabilities of ChatGPT. To compare AI translation capabilities, this paper uses novel sentence as show in Fig. 10. It is one of the very famous English novels written by American Korean in USA and develop drama and movie. In 7-page of this novel, there is original story: "What I wouldn't give to have a grandson of my own one day," the matchmaker said, making her closing gambit while peering hard at the boardinghouse keeper's creased, brown face."

Korean translation: "지도 손자를 볼 수 있다면야 뭐든지 줄 수 있다 아입니까" 중매쟁이가 훈이 엄마의 주름진 구릿빛 얼굴을 뚫어지게 들여다보면서 승부수를 던졌다.

WRN [55]

"내가 언젠가 내 손자를 갖게 되었으면 하는데," 라고 중매쟁이가 말했습니다. 그녀는 주름진 갈색 얼굴의 여관 주인을 뚫어 쳐다보며 마지막 제안을 했습니다.

챗 GPT

"나는 언젠가 내 손자를 가질 수 있다면 무엇이든 주겠어요,"라고 중매쟁이가 말하며 마무리 수를 두고 하숙집 주인의 주름진 갈색 얼굴을 뚫어지게 쳐다보았다.

Liner.AI [56]

"내가 언젠가 나만의 손자를 가질 수 있다면 얼마나 좋을까요," 중매인이 말했습니다. 그녀는 보딩하우스 주인의 주름지고 갈색 얼굴을 주의 깊게 바라보며 최종 제안을 했습니다.

Gemini [57]

The translation of the sentence "What I wouldn't give to have a grandson of my own one day," the matchmaker said, making her closing gambit while peering hard at the boardinghouse keeper's creased, brown face" is:

"언젠가 손자가 생기면 좋을텐데..." 중매쟁이는 하숙집 주인의 주름지고 검게 탄 얼굴을 じっと (じっと - ji っと - intently) 들여다보며 마지막 제안을 꺼냈다.

Here's a breakdown of the translation:

"What I wouldn't give to...": This is a common English idiom that translates to a strong desire for something. Here, it's translated to >"언젠가 손자가 생기면 좋을텐데..." (eoneunga sonsaganeun saenggimyeon johaltende...) which literally means "It would be nice if I had a grandson someday..."

"closing gambit": This refers to the final attempt to persuade someone in a negotiation. Here, it's translated to >"마지막 제안을 꺼냈다" (majimak jeaneul-eul kkeonaedda) which means "she took out her final proposal."

"peering hard": This means looking intently or closely. Here, it's translated to >"じっと (じっと - ji っと)" (jitto) which is a Japanese adverb meaning "intently" and is commonly used in Korean as well.

"creased, brown face": This descriptive phrase is directly translated to >"주름지고 검게 탄 얼굴" (jujeumjigoseo geomge taneun eolgul) which means "wrinkled and tanned face".

I hope this translation is helpful!

Info; www.readinggroupguides.com/reviews/pachinko/excerpt

In the above, there are several types in translation but how much close to the story mean and the best nuance for original story. That is, only literatures can understand and suggest on how AI function is useful and how we have to develop AI and use!

K. Suggestion of Curriculum Design of K-12 for Education of AI Literacy, AI Thinking, and AI Literature

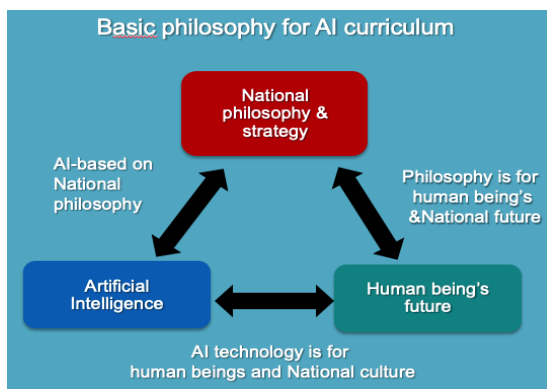


Fig. 11. The basic philosophy for AI curriculum.

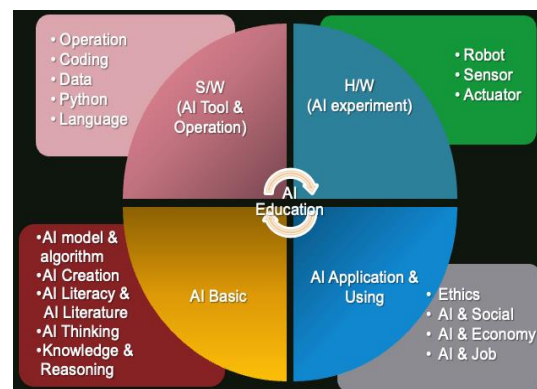


Fig. 12. Subject structure for curriculum design.

This paper suggests the design principle for the effective education of AI literacy, AI Thinking, and AI literature as shown from Fig 11 to Fig. 14. To educate AI paradigm (AI Thinking, AI Literacy, and AI Literature) effectively, we have to introduce the philosophy of national, human being's status or future and AI purpose as shown in Fig. 11.

That is quite important for AI education. Based on this purpose, we can establish curriculum for AI subject to teach and learn.



Fig. 13. Education approach.

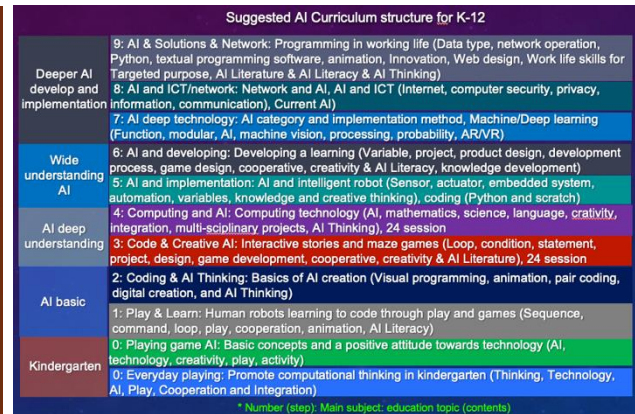


Fig. 14. The detailed subject structure for curriculum.

Fig. 11 shows the basic philosophy for AI curriculum on how to approach to educate. Fig. 12 is basic subject structure for curriculum design. Fig. 13 represents how to educate AI education (education approach) To effectively educate, we have to use all implementation methods such as mobile, online and offline, seminar, and exchange program for our focuses. Of course, AI education should show vision and target through these methods. Fig. 14 illustrates the detailed subject structure for curriculum of each level.

III. CONCLUSION

Currently, the nature of working and the range of activities with AI have been changing dramatically because of variety function of AI including ChatGPT. As the possibilities of AI application is increasing and the commercial AI technologies have been transforming for everywhere, it is absolutely needed to extend in different ways for thinking about AI.

That is, AI Thinking is relevant to users of AI systems such as, choosing inputs, working with outputs, AI developers (design and implementation of AI technologies), IT and team managers (determining the platforms and AI practice of organizations for use), policymakers (government and organization), and data (data getting and handling for the use of AI).

Because AI Thinking has a multi-purpose meaning of the various aspects about AI use and it has a wide range of the management, the production, the training, and use of AI systems, it is needed to educate systematically to understand and learn with literature (this paper call as AI literature). Without introducing literature, the education of AI Thinking and AI literacy cannot implement.

Through education, AI Thinking can help guide the training of AI professionals, developers, technical managers, and AI researchers in technical and social sciences.

Of course, through the education, AI Thinking provides a structure for interdisciplinary AI teams (management and collaboration, evaluation) for industrial practice.

AI Thinking is quite important for AI literacy in students and higher education, professionals and the public people because AI Thinking provides a model to guide training as well as self-learning in professional and practice-based settings. For more AI literacy, it should also focus primarily on understanding how AI works and what its implications are.

AI Thinking should be recognized as an element of AI literacy, at least for practice-based education and professional experts. However, it is important to distinguish, learn, and educate AI Thinking focused on AI practice, methodological, and context from more general-purpose AI literacy and AI literature.

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