Practice of Tunnel Engineering Teaching With the Consideration of AI Application

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Abstract

The influence of the powerful generative artificial intelligence (AI) on education is reshaping the mode of education procedure. We should integrate AI in education to adapt to the potential of generative AI unsettling and upending in learning and teaching practice, as education today is crucially intertwined with technology, in terms of educational content and pedagogy. However, it is still on the way how to consider the functions of AI application in a professional course learning and teaching. We need specific experience from practice to make the AI application increasingly effective. Here is the practice of Tunnel Engineering teaching with the consideration of AI application, in terms of course content and presentation style design, the evaluations of both the reflection of the learning and teaching procedure and learning results. The results of the two-semester course teaching and near 120 students' learning evaluated with quiz, assignments open-book tests and course project in terms of Bloom's taxonomy, indicate (1) as we are taking the advantages of AI application in this professional course learning and teaching, the misleading or temporary prosperity induced by the abundant multi-functional information could blur student cognition developing; (2) students are skillful in AI application to sample information to finish objective issues, while most of the students are lost in subjective issues, where there need personal judgement and decision-making with various information; (3) it is vital to underline student personal thinking in learning procedure and timely evaluate the learning results under this plentiful and challenging education environment.

Keywords: practice, tunnel engineering teaching, AI application, learning evaluation

Introduction

Artificial Intelligence (AI) is rapidly evolving (Samala et al., 2025) and increasingly reshaping education modes, as the education today is crucially intertwined with technology. Open GenAI tools such as ChatGPT and DeepSeek are directly or indirectly everyday companions in the tertiary learning and teaching activities. A global survey indicated that 86% of university students now use AI in their studies, with more than half engaging with these tools weekly (DEC, 2024). The influence of the GenAI on education is increasingly significant, such as in terms of learning and teaching.

It is vital to integrate AI in education to adapt to the potential of GenAI unsettling and upending in learning and teaching practice. As we use GenAI tools, it should be recognized that these tools are not specifically designed with educational goals since the large language models generate responses using probabilistic language modeling, rather than through conceptual understanding or reasoning (Vendrell & Johnston, 2026). The effectiveness of the AI tools heavily depends on how they are used (Samala et al., 2025). To be able to handle it appropriately, ethically, and efficiently, we need understanding the benefits and challenges of AI applications. For example, GenAI could support learning on the condition that being guided by clear teaching principles (OECD, 2026). However, if GenAI is used without pedagogical guidance, outsourcing tasks to GenAI simply enhances performance with no real learning gains, such as due to cognitive offloading and metacognitive disengagement (OECD, 2026). Similar findings of the impact of a range of digital tools on student learning outcomes shows that access to technology alone does not guarantee educational gain and successful digitalisation also requires pedagogical, not solely technical solutions (Forsström et al., 2025).

In general, the outputs of the GenAI tools are statistical recombination and imitation of the knowledge, experience, and works accumulated by humans over the past. As a learner, we need genuine personal experience to develop thinking capacity, as well as to cope with practical issues. As information is readily available, we need question what is correct and rectify information with critical and creative thinking before making decisions. It is suggested that institutions must ensure AI complements traditional learning, uphold academic integrity, and promote critical thinking (Nguyen, 2025). Emerging researches on the effects of the application of generative AI tools in education (e.g., Deng et al., 2025; Gerlich, 2025) indicated both beneficial and harmful outcomes, which are contingent rather than fixed (Vendrell & Johnston, 2026). We need the competency collaborating with AI systems in higher education on the condition without surrendering cognitive agency. However, in his transforming process, there is short of mature experience from practice to make the AI application increasingly effective, such as in terms of specific course learning and teaching. As a course is of service to students' capacity development, the effects of AI applications in the course learning should be timely assessed to follow student-centered education principle. Here is the preliminary practice of the Tunnel Engineering course learning and teaching with AI application under consideration.

Considerations in Practice

In the learning, process is more important than result as reflection should be embedded in the activity. Education is to cultivate student learning capacity, such as to study in vague, open, and long-term immersion fields, with complex systems thinking and deep philosophical understanding. In other words, learning is an experience involving process. The core of experiential learning lies in the fact that learning is not a passive reception and reproduction of static knowledge, but rather an active experience of the knowledge meaning through a cycle of action, reflection, abstraction, and re-experimentation in real or simulated situations, and the construction of the meaning of learning and developing the ability to apply knowledge accumulated. The thinking capacity developing would focus on the abilities proposing original questions, making judgment in complex situations, extracting unique insights from experiences. The focus of a course is to contribute to these capacity developing, such as in terms course consideration, implementation plan and result evaluation.

Education is to serve society. Engineers would be involved in various cognitive processes, including problem-solving, decision-making, and reflective thinking in the future practice, which is of dynamic features. Therefore, the graduates would have the basic capacity of navigating and coping with the complex and dynamic environments. In terms of learning, the development of critical thinking is one of the basic capacity to make reasonable decisions (Halpern, 2012), is one of the key natures and fundamental cognitive skills for professional competence (Gerlich, 2025).

Impact From AI Application

The impact of AI technology on higher education is pervading in almost aspects. AI tools offer undeniable benefits in terms of efficiency and accessibility (Gerlich, 2025). During course learning and teaching, AI tools would provide environmental support for self-directed learning, resource platforms for personalized learning, and precise empowerment for learners with learning difficulties. Under AI's pervasive influence, the transition of both teaching and learning models is imperative. For example, the importance of traditional knowledge learning in higher education has significantly decreased and the cultivation of students' thinking abilities has become increasingly important. As information is readily available, one of the characteristics of the AI era is the increasing uncertainty. In this context, traditional thinking aimed at pursuing a single deterministic answer will no longer be applicable. In contrast, the cultivation of systems thinking, engineering thinking and creative thinking has become more important. Critical thinking is increasingly vital to cope with the dynamic situations, as considering the negative effects of AI application on critical thinking, such as cognitive offloading, diminishing users' engagement in deep, reflective thinking processes (Gerlich, 2025; Vendrell & Johnston, 2026). The effect of the AI application on learning outcomes, especially on critical thinking development should be evaluated in a course procedure.

Features of Capacity Requirements for the Course

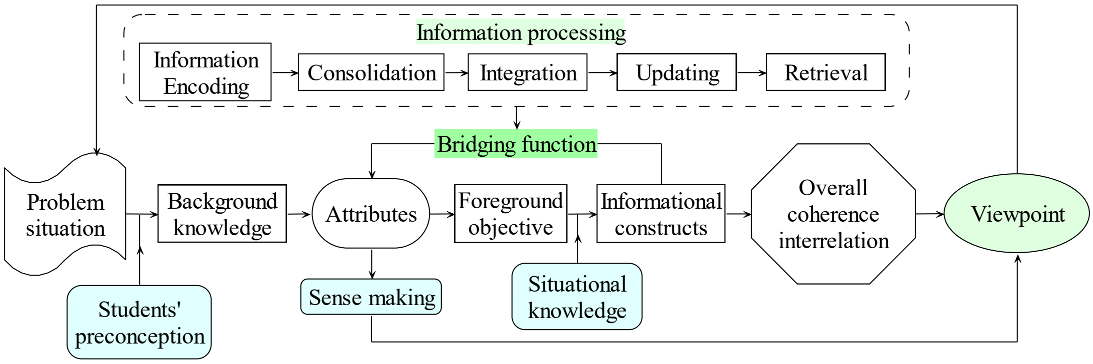
In simplicity, Tunnel Engineering is a subject dealing with the planning, design, construction, operation and management of tunnels and underground structures. With the numbers and complexity of tunnels and underground structures increasing, the information pertaining to the Tunnel Engineering is accordingly accumulating. The features of the professional capacity requirements in the field of Tunnel Engineering would be under consideration in the course learning and teaching.

Features of the Course

Of a professional course learning, we need understanding of what data, information, knowledge, and wisdom mean to us and how their interrelating enables us to define and move along a knowledge building pathways (Kaipa, 2000). Date and information could indicate us hints to do things right, while knowledge means knowing making decision in a case. Students would transform from information accepting into an information assimilating in terms of knowledge building and capacity developing. It is a procedure of making the information separated to be assembled into a student's knowledge system, as shown in Figure 1. As the related information is too plentiful to be fully considered in the course learning and teaching practice, the course activity would focus on the basic information and knowledge, pertaining to the essential concepts, principles, theories, technologies in the field of tunnel and underground structures, such as with the application of systems thinking (Ma, 2022).

In general, there is professional tacit knowledge, which is characteristics of the unspoken expertise residing within personal mind. Tacit knowledge encompasses the practical skills, intuition, and personal experience that drive efficiency but are too complex to be written down. These subjective and personal insights would be learned through experience and operate under specific contextual intuition.

Figure 1
Information Processing, Sense Making and Knowledge Building Procedure



Note. Modified from Labour (2014).

Capacity Requirements

In terms of student capacity development, professional course learning would include learning ability and professional competence. Both of them depend on the level of critical thinking and sense making under complex situation. For example, a qualified engineer would have professional judgement to cope with complex project situation. During intrapersonal knowledge building or creation, there needs personal ability of verbal formulations to capture the essence of various aspects of unformulated experience, such as in terms of a step towards theorizing key aspects of an informational process, as sketched in Figure 1. This is a sense-making process under a specific situation and is strengthen by the bridging function of informational constructs and bringing together attributes that deduce from learner's sense-making process, with reflection and knowledge structuring being involved. Otherwise, the loosely accumulated knowledge will be meaningless or dissipated (Labour, 2014). Recently, the researches on memory storage and management mechanisms indicate that effective memory framework would consist of memory extraction, updating, retrieval, and utilization, enabling persistent experience regulation and long-range reasoning, and evolve from continuous learners long-range reasoning capacity (Liang et al., 2025). Otherwise, the process would be cognitive offloading and unfavorable to critical thinking skills developing (Gerlich, 2025) when individuals delegate cognitive tasks to external aids, reducing their engagement in deep, reflective thinking (Carr, 2010; Sparrow et al., 2011).

Evaluation Points and Parameters

Where a new education technology or education innovation in application, its impact on the learning and teaching would be timely evaluated with proper measures. However, there is often without a common language for impact or a consistent framework to measure and demonstrate it (DEC, 2026), such as in terms of shared understanding of what “impact” means or what success looks like, qualitative impact being largely uncaptured. As the learning process would be negatively influenced by improper AI tool usage such as due to increased cognitive offloading (Gerlich, 2025), the practice of a course plan implementation should be evaluated with proper measures (Vendrell & Johnston, 2026).

Evaluation Points

With learning procedure is under consideration, the learning evaluation would be executed in a dynamic mode. The main focus of the evaluation is to evaluate the influence of AI tool application on student’s capability development in this study. To meet the various social requirements, the course evaluation points are of college characteristics, such as in terms of knowledge-level, personal abilities and objectives. Following the well-accepted parameters of personal capacity in social evaluation field, such as the Bloom’s taxonomy (Anderson & Krathwohl, 2001), we consider creative thinking as top-level or higher-order. In terms of evaluating the influence of AI tools application on the cultivation of critical thinking, we consider mainly the cognitive ability development and metacognitive engagement in learning process, since improper use AI tools can attenuate critical thinking, such as due to cognitive offloading, metacognitive disengagement and epistemic narrowing (Vendrell & Johnston, 2026).

Parameters

The evaluation parameters would serve the key focus to investigate the influence of AI tool application on student critical thinking developing in the course learning process. Following the Bloom’s taxonomy (Anderson & Krathwohl, 2001) and the parameters proposed by Vendrell and Johnston (2026) to evaluate the student intellectual processes in AI-applied learning environments, we consider the evaluation parameters, indications and practical cases (Table 1) in the course learning and teaching procedure. As noted by Vendrell and Johnston, (2026), these parameters are indeed interrelated processes, with the indication of learner’s thinking and critical engagement, and could underpin higher-order thinking and critical engagement as learners navigate the epistemic affordances.

Table 1
Evaluation Parameters, Indications and Practical Cases in the Course Implementation

Parameters	Capacity indications	Practical cases in evaluation
Conceptual interpretation	Understanding, analyzing	Quiz, open-book test, closed-book and final exam
Inferential reasoning	Analyzing, evaluating, creating	Homework, course project, open-book test, closed-book and final exam
Evaluative judgement	Evaluating, decision-making	Homework, course project, open-book test, closed-book and final exam
Metacognitive regulation	Metacognitive monitoring and regulation	Homework, course project, open-book test, closed-book and final exam
Intellectual curiosity	Inquisitiveness, flexible thinking	Homework, course project, open-book test
Epistemic integrity	Truth-seeking, ethical reasoning	Homework, course project

Practice Evaluation and Results

Based on anonymous investigations on the situation of AI tools application in study, such as at course starting and during the course procedure, the two semesters results are similar. Nearly all of the students are using AI tools as a key referring measure in fulfilling academic assignments, such as homework, project and essay writing, though there is deference in tools option and the degree of dependence. They prefer AI tools in reference information sampling to the traditional browsing printed literatures. Therefore, we consider the course plan with AI application. During the course plan implementation, lecturing, extemporaneous discussions and minor quiz are still the main performance modes. The evaluation on the influence of the AI tools application on the students learning and capacity development mainly focus on the students' performance in the issues outside the classroom, including homework, course project, review report or essay writing on a specified topic. Open-book test and quiz within limited time are also used in the course process. The student learning efficiency and results would be generally checked with summative assessment measures.

Evaluation in the Course Practice

To cope with the dynamic and complex practical situations, professional course is to promote student thinking, being, and acting in the future. Therefore, professional education would improve student capacity for self-understanding, social critique, and principled action. These capacity would be generally evaluated with the parameters conceptual interpretation, inferential reasoning, evaluative judgement, metacognitive regulation, intellectual curiosity and epistemic integrity, as shown in Table 1. The evaluation points with the specified measures for the evaluation parameters are presented in the Table 2, to assess how critical thinking can be cultivated in AI-mediated learning environments, including dispositions at risk when AI tools are used uncritically (Vendrell & Johnston, 2026).

Table 2
Key Points of the Evaluation Measures for the Evaluation Parameters

Parameters	Key points of the evaluation measures
Conceptual interpretation	The ability to construct meaning by selecting, organising, and integrating information; to clarify concepts, discern relationships, and translate complex ideas into one's own understanding; to distinguish core ideas from peripheral details, reconcile competing views, and connect new input to prior knowledge
Inferential reasoning	The ability to generate reasoned conclusions from evidence; to identify assumptions, discern logical relationships, and predict implications; to construct arguments, identify causal links, test hypotheses across contexts, reason and make decision under uncertainty
Evaluative judgement	The ability to assess the credibility, coherence, and evidentiary basis of information and arguments; to compare competing interpretations and determine whether conclusions follow logically from premises; to judge the quality and relevance of information sources, especially under uncertainty
Metacognitive regulation	The ability to monitor, evaluate, and control one's cognitive processes during learning and reasoning; to assess task demands, recognise cognitive biases, and modify their approach with errors or gaps being detected
Intellectual curiosity	The motivation to explore ideas and questions, and pursue knowledge beyond requirements
Epistemic integrity	The traits of truth-seeking and fair-mindedness; the intellectual honesty with critical reflexivity

The evaluation is performed with formative and summative assessment measures, including course time presentation, quiz, homework, essay writing, course project, open-book test, midterm and final exams. Some of the assessment topics are specifically designed with AI application under considerations. Students are positively encouraged to indicate their AI tools usage levels and modes. In the formative assessments, the skills of the AI tools usage are also evaluation factor. The students submits are valued with the key points of the evaluation measures as reference indicators for the parameters, respectively.

Results

The results of the two-semester Tunnel Engineering course teaching and near 120 students' learning, evaluated with quiz, assignments open-book tests and course project in terms of the parameters (Table 1), the preliminary evaluation results on the effect of AI tools application in the learning are the followings.

Students are generally skillful to adapt to use an AI tool and to manage information available to fulfill a standardized task, such as answer a question without high logical or reasoning thinking being involved. More than half of the students can offer a polished essay writing on a specified topic, at least deferring to surface-level coherence. However, students' performance are not same as intuitive judgement when they are accomplishing a relatively complex task with the critical thinking parameters (Table 2) being involved. As the students learning performance being evaluated as well, fair and poor with the compliance to the evaluation measures, respectively, the statistical evaluation results are shown in Table 3. In general, the well-performance ratio varies from 0.18 to 0.37, which is similar to the excellent ratio of student course achievements. In historical comparison, the student performances in AI-mediated environments are not superior to that of their antecedent peers, such as in terms of total score, results of summative test and course project, where critical thinking is underlined in assessments. The preliminary results imply that the AI-mediated environments, with plentiful information readily available, efficient and convenient tools, do not directly improve student capacity-building effectiveness, especially with critical thinking under consideration. Timely assessment of the learning and teaching procedure is indispensable in underpinning the importance of student’s personal thinking under this plentiful and challenging education environment. It seems there need some additional measures being underlined to help students effectively taking advantage the AI era in a professional course learning.

Table 3
Evaluation Results of Learning Performance With Critical Thinking Under Consideration

Parameters	Well	Fair	Poor
Conceptual interpretation	0.37	0.51	0.12
Inferential reasoning	0.31	0.42	0.27
Evaluative judgement	0.25	0.39	0.36
Metacognitive regulation	0.22	0.36	0.42
Intellectual curiosity	0.18	0.31	0.51
Epistemic integrity	0.22	0.49	0.29

Discussion

In the era of AI widespread and deep penetration, the applications of GenAI tools would improve productivity in education and professional fields (e.g., DEC, 2026; Lee et al., 2025; Noy & Zhang, 2023). Based on the development trend of GenAI tools, it can be predicted that in the near future, all quantifiable, decomposable and repetitive works will ultimately be replaced by AI. For example, AI can quickly generate answers, charts, and solutions in response to a requirement. Under this situation, real knowledge will no longer be static information that requires mechanical memorization, but dynamic resources that need to be flexibly applied, critically questioned, creatively reconstructed and extended. Learning mode will inevitably undergo drastic changes to adapt to the new environment. It is necessary to clarify what skills can adapt to future needs, such as engineering and technical personnel doing. The existing consensus includes issues that cannot or are difficult to model. AI can improve efficiency, but tools cannot replace human's underlying abilities. For example, the ability to propose core questions based on reality and make value judgments on the results. Among them, critical thinking is indispensable. Learning is to cultivate what fuels you.

The results from the above-mentioned course practice imply that we need underline how to make the AI tools working effectively and thoughtfully in professional course procedure, such as in terms of student critical thinking developing. To be favorable to student critical thinking developing, the recent researches (e.g., Lee et al., 2025; Premkumar et al., 2025) shot light on the aspects of disposition towards critical thinking, with critical openness and reflective skepticism, such as information verification, engineering thinking and being actively engaged with learning context. These issues give the key preconditions of AI application in an effective professional course learning.

Learning Thoughtfully With AI Application

Crucially, any benefit of offloading due to AI application will be contingent on the fact that the demand being offloaded is unnecessary with respect to the learning goal. Internal demand and metacognitive evaluations of demand play a crucial role in offloading, since cognitive offloading can have downstream effects on our low-level cognitive capacities and our subsequent metacognitions (Risko & Gilbert, 2016).

In a learning process with AI application, we need consider that the world facts are objective and rich, but the narrative is subjective. The information or knowledge presentations, such as in forms of word, figures and tables, are the extract fragments or partial information of the facts to state or display. What is actually stated is magnified, while the parts that are not stated are weakened or even ignored. Learning is a process of constantly accumulating knowledge and skills, which is arduous and challenging. The learning process without goals is difficult to sustain and reflect on, and the understanding of information available will not be profound. Learning thoughtfully needs reflection and metacognition being actively involved. For example, scientific argumentation tasks can be adopted as the instructional context to engage learners in explanation, monitoring, and revision, and to keep higher-order cognitive responsibility on the learner’s side (Sun et al., 2026). Similarly, self-regulated learning, which includes the components—metacognition, cognition, and lifelong learning capabilities, would be favorable to cultivate innovation competencies encompassing curiosity, creativity, computational thinking and systems thinking (Maheshwari & Bhatt, 2025). This means an effective learning is thoughtful, object-oriented process, with critical thinking being one of the motivations.

The survey results of the impact of GenAI tools on knowledge workers critical thinking (Lee et al., 2025) indicate that higher confidence in AI is associated with less critical thinking, while higher self-confidence in one’s own abilities is associated with more critical thinking and more effort in verification of the AI-generated content, and that several barriers, such as a lack of awareness of the need for critical evaluation, limited motivation due to time pressure, and difficulty in refining prompts—especially in unfamiliar domains, would inhibit critical thinking in AI using. This implies that there are preconditions for affective AI application in learning process, such as information verification, engineering thinking and being actively engaged with learning context.

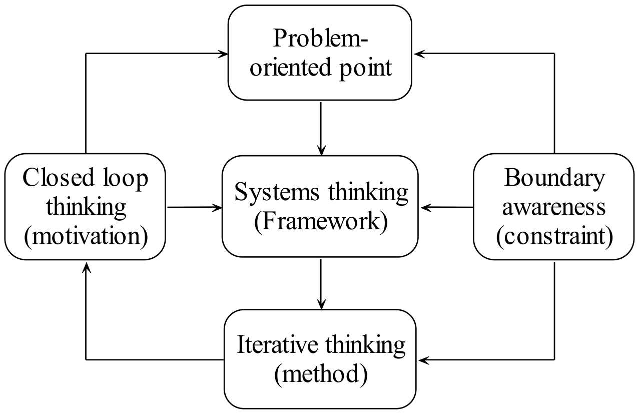
Learning With Engineering Thinking

As information and knowledge are readily available in AI era, the capacity of understanding and transferring the information into personal knowledge system, as well as evaluating problem and creating solution to a practical requirement, is increasingly vital to a student professional competence. An efficient learning approach includes making the knowledge points under consideration into one’s thinking chains or system. In other words, learning is not a passive reception and reproduction of static knowledge, but rather an active experience of the wisdom of knowledge through a cycle of action, reflection, abstraction, and re-experimentation in real or simulated situations, and the construction of the meaning of learning and the ability to apply knowledge to practical issues. For example, when we are learning at something, we need to know not only the basic concepts, principles, theory, etc., but also what are the relationships between them, such as in terms of practical project. The key focus is to develop the ability to deeply abstract and reason about complex physical phenomena and causal relationships. These capacity seems the precondition to know which direction to look in practical project.

Engineering issues are of professional characteristics. Each discipline has its own unique way of thinking—a method of interacting with the world, such as professional custom and decision-making habits, which would be presented with tacit knowledge. In general, tacit knowledge refers to the subjective and personal insights one gains through experience and intuition, which are difficult to document, transfer, and articulate. However, in a professional field, knowledge is presented with concepts, theories and principles in a systemic style, which are presented in highly refined and abstract forms. We can consider the knowledge is the results of predecessors' comprehension condensed. Reading these information is not meaning understanding knowledge, since the refined knowledge could appears with direct indications of how predecessors comprehending, experiencing, anticipating, and simplifying the knowledge. True understanding needs a mental image, a sense, a predictive judgment of what this thing might be like, and only then does abstract presentation step in to transform the prediction into a rigorous expression. These preceding mental activities are usually presented as intuition, which is of professional characteristics and seems indispensable for a full knowledge understanding procedure. To grasp professional knowledge, intuition is sometimes necessary for something that cannot be fully attained by merely reading books. An effective learning process involves personally experiencing context exploration and reflection.

Engineering thinking focuses on how engineers thinking and making decisions, such as transiting vague ideas into physical issues in complex systems and uncertain conditions. This requires engineers start from practical problems to form a systematic solution and implement it into a project, with continuously iterating under real constraints. In other words, a well-developed practical engineering thinking is a closed loop thinking from practice to theory and back to practice. For example, engineering thinking would be considered being founded onto five components of problem-oriented points, systems thinking, iterative thinking, boundary awareness and closed loop thinking. Problem orientation is the direction, system thinking is the skeleton, iterative thinking is the method, boundary awareness is the guardrail, and closed-loop thinking is the engine. The combination of the five components is the complete engineering thinking, as shown the Figure 2. When a learner considers learning text under an engineering thinking context, there is good chance of reflection and information verification, as well as being engaged with the learning procedure. It seems one of the approaches of understanding professional knowledge, with personally experiencing context exploration and reflection effectively involved.

Figure 2
The Combination of the Five Engineering Thinking Components



Timely Evaluating the Learning Results

As the knowledge could be considered as distillation information presentation, which is characteristics of concise, abstract features. In terms of capacity developing, reading and learning knowledge available is not just about repeating a predefined procedure, such as knowing how to perform a calculation with a theory equation, but also about re-entering the path of understanding what happens in thinking developing. It is exactly what teaching and learning should do to cultivate personal thinking capacity. Otherwise, there is a good chance of thinking offloading in a learning procedure, mainly due to the readily available information, as well as the direct respond from AI tools for a question. Once attention becomes fragmented, thinking also becomes fragmented. As a person is immersing in easily available information, fragmented knowledge, it is difficult to develop engineering thinking habit and decision-making capacity without critical thinking being involved. This means learning procedure would be timely evaluated, such as in terms of the learning results, as well as the information verification capacity under this plentiful and challenging education environment.

When faced with complex and multifaceted information, we often rely on intuition to extract the key clue from the chaotic information. Intuition would be cultivated through practical examples, scenarios, analogies, experiments and repeated deliberation. For example, we understand a theoretical problem through experience, some guesswork, model or sketch, and then get a rough idea of the answer to the problem. To this point, knowing the answer does not mean that there appears exact numerical values, but first knowing the approximate shape, geometrical feature, limit behavior, and magnitude of the result. It is first making judgments, and then entering mathematical or abstract presentation. The preliminary judgment would be updated with the issues are proceeding. When this process is performed, learner is engaged with the context and meaningful issues.

Engineering practice is problem-oriented. The ability to solve problems is based on defining, breaking down, and analyzing issues, as well as understanding, interpreting, and applying existing information. Information does not automatically become cognition to finish these tasks, as judgments and decision-making are essentially the result of information interpretation, not the result of information itself. The same world, with different interpretations, yields different outcomes, because interpretive ability determines what a client focuses on and how to connect the related information. Of learning issues, the cultivation of cognitive skills is the core. It requires one's own framework for interpretation, as shown in Figure 1. Therefore, the evaluation would be timely service for this capacity developing process in a course teaching practice.

Conclusion

Base on the preliminary practice of the Tunnel Engineering course learning and teaching with the AI application under consideration, the conclusions are as followings. (1) As we are taking the advantages of AI application in this professional course learning and teaching, the misleading or temporary prosperity induced by the abundant multi-functional information could blur student cognition developing. (2) Students are skillful in AI application to sample information to finish objective issues, while most of the students are lost in subjective issues, where there need personal judgement and decision-making with various information. (3) It is vital to underline student personal thinking in learning procedure and timely evaluate the learning results under this plentiful and challenging education environment. (4) It is beneficial to encourage students' being engaged with information verification to enhance student critical thinking developing.

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The author declares that no AI or AI-assisted technologies have been used to generate, refine, or correct the content in the manuscript. The ideas, design, procedures, findings, analyses, and discussion are originally written and derived from careful and systematic conduct of the research.

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