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Teaching UX Design to Engineers in the Age of Artificial Intelligence: The Double Diamond as a Framework for Reskilling

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Abstract: As generative artificial intelligence transforms software development and digital design practices, engineering education must address the interplay between technical expertise, an understanding of user needs, and critical judgment. This article examines the contribution of UX Design education to this evolution, using the Double Diamond model as a framework for structuring the design process. The research is based on a pedagogical experiment conducted at the École Supérieure Privée d'Ingénierie et de Technologies (ESPRIT) in Tunisia, as part of a 21-hour module for fourth-year students in web and mobile development during the 2025–2026 academic year. The methodological approach is based on the observation of teaching practices and the analysis of student work, including user interviews, personas, usage scenarios, and prototypes. The Double Diamond framework organizes the process into four phases: discover, define, develop, and deliver. It allows for an examination of how students explore usage scenarios, reframe problems, develop solutions, and subject their proposals to evaluation. The article also proposes a cross-cutting examination of the role of generative artificial intelligence in these phases, distinguishing between assisted production and the validation of design choices. It advances the hypothesis that teaching UX design can help broaden the skill set of future engineers, provided that technical mastery is integrated with human understanding, experimentation, and decision-making responsibility. This exploratory research proposes an analytical framework for studying this integration without presupposing the effects of the approach prior to the analysis of empirical data

Keywords: *UX Design; Double Diamond; Engineering Education; Generative Artificial Intelligence; Design Thinking; Human-Centered Design; Cross-Disciplinary Skills.*

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I. INTRODUCTION

As artificial intelligence learns to produce, engineers must relearn how to design for humans. The widespread adoption of generative artificial intelligence tools is gradually transforming practices in software development, content production, and interface design. Tasks that previously required significant technical investment can now be assisted, accelerated, or partially automated. This evolution does not render technical skills obsolete, but it does prompt us to examine how they relate to other abilities: understanding needs, interpreting usage scenarios, formulating relevant problems, and evaluating the consequences of proposed solutions.

In engineering education, mastery of scientific methods, technical tools, and problem-solving procedures remains essential. However, the success of a digital product does not depend solely on its technical feasibility. It also depends on its ability to meet real needs, fit into a usage context, and provide a comprehensible and tailored experience. A functional interface alone does not guarantee that it will be relevant to the people who use it.

Design offers a complementary perspective for addressing this complexity. Cross (2006) shows that design involves specific modes of knowledge and reasoning. Buchanan (1992) emphasizes that design problems are often complex, open-ended, and difficult to define. In such situations, design involves not only selecting a solution but also understanding the situation and reformulating the problem as the process unfolds.

UX design enables this approach to be applied in the development of digital products and services. It encourages future engineers to view users not merely as recipients of a technical solution, but as active participants whose practices, perceptions, and constraints all contribute to defining the problem. This approach aligns with the principles of human-centered design, which recommend taking users, their tasks,

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and their environments into account throughout the design cycle (International Organization for Standardization [ISO], 2019).

In this context, the Double Diamond model offers a particularly relevant framework for teaching and analyzing the design process. Popularized by Stephan Vial in 'Le design'(2017), it distinguishes four phases: discover, define, develop, and deliver. Its structure is based on an alternation between divergence and convergence: broadly exploring a situation, clarifying the problem, generating multiple potential solutions, and then selecting and refining a proposal. The model thus highlights a fundamental distinction for future engineers: understanding the problem is not the same as producing the solution.

The advent of generative artificial intelligence reinforces the relevance of this line of thinking. These tools can assist in generating ideas, drafting scenarios, generating code, or creating initial interface proposals. They can accelerate certain activities and expand the range of possibilities explored. However, the fluidity of the creative process does not guarantee either the validity of the information used or the suitability of a solution to users' actual needs. The work of Dwivedi et al. (2023) and Kasneci et al. (2023) thus calls for a joint examination of the possibilities offered by these technologies and the requirements for verification, accountability, and critical judgment that they entail.

This paper fits within this framework and is based on a pedagogical experiment conducted at the Ecole Superieure Privee d'Ingenierie et de Technologies (ESPRIT) in Tunisia. The module under study, dedicated to UX Design and the UX Design Thinking approach, is intended for fourth-year computer science students specializing in web and mobile development. The Double Diamond is taught as a framework for structuring user research, problem definition, solution development, and delivery.

The central question of this research is as follows:

How does teaching UX Design, structured around the Double Diamond model, help reshape engineers' skills in the era of generative artificial intelligence?

The hypothesis put forward is that teaching UX Design can help broaden the way future engineers approach computer science problems. By guiding them to explore uses, reformulate needs, develop multiple avenues, and evaluate their proposals, the Double Diamond can foster a closer integration between technical reasoning, human understanding, and critical judgment. From this perspective, AI is viewed as a collaborative tool whose outputs must be questioned, verified, and reoriented by the designer.

This article has three objectives: to analyze the theoretical foundations of the Double Diamond in engineering education; to describe its integration into a UX Design module; and to propose a framework for studying the skills employed in each phase, as well as the cross-cutting role of generative AI in the design process.

II. LITERATURE REVIEW: DESIGN, THE DOUBLE DIAMOND, AND THE TRANSFORMATION OF ENGINEERING SKILLS

- *Design as a Way of Thinking: Moving Beyond Technical Problem-Solving*

Design is frequently associated with the creation of forms, the production of objects, or the aesthetic improvement of existing solutions. However, this view does not capture its cognitive and methodological scope. Design can also be understood as a particular way of knowing, interpreting, and transforming a situation.

Cross (2006) uses the concept of designerly ways of knowing to refer to the forms of knowledge characteristic of the design process. These rely in particular on the ability to mobilize mental representations, explore multiple possibilities, work with incomplete information, and construct proposals whose relevance must be progressively evaluated. Design thus possesses a line of reasoning that complements scientific and technical approaches.

This complementarity is particularly important when the initial problem is not clearly defined. Buchanan (1992) describes many design problems as complex problems whose boundaries, causes, and criteria for resolution may evolve. In such situations, the engineer cannot simply select the best solution from among predefined options. The engineer must also examine the situation, identify the stakeholders involved, and reformulate the problem based on the information gathered.

Dorst (2011) explores this aspect in greater depth by emphasizing abductive reasoning and the creation of interpretive frameworks. In design, abductive reasoning allows one to conceive of proposals that might address a situation and then examine the conditions under which they could be relevant. This activity combines exploration and evaluation: proposals must be tested against practical applications, technical constraints, and the consequences of decisions.

In the field of computer science, this perspective moves beyond an exclusively linear view of development, in which a clearly formulated request is simply translated into specifications and then into code. This approach remains necessary, but it can prove insufficient when the initial request only imperfectly reflects users' practices or challenges.

UX Design makes this aspect particularly visible. It is not merely a matter of improving the appearance of an interface, but of examining the interactions between people, features, environments, and usage goals. Krippendorff (2006) emphasizes the importance of meaning in design, while Norman (2013) shows that usability issues can stem from design choices that make available actions difficult to understand.

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Design can thus be viewed as a practice of problem framing, exploration, and evaluation. This conception provides a theoretical foundation for introducing the Double Diamond into engineering education: the model gives visible form to cognitive processes that might otherwise remain implicit.

- *The Double Diamond: Structuring Divergence and Convergence*

The Double Diamond model, associated with the Design Council, represents the design process through two phases: understanding the problem and deeply developing the solution. Each phase is characterized by a divergent movement, which opens up the field of possibilities, and a convergent movement, which allows for the selection and refinement of a direction.

The first diamond focuses on the problem. The "Discover" phase involves exploring the situation, gathering information, and understanding the people involved. The "Define" phase allows for synthesizing the data and formulating a specific design problem. The second diamond focuses on solutions. The "Develop" phase opens the door to exploring several ideas and proposals, while the "Deliver" phase involves testing, refining, and preparing for the implementation of the chosen solution.

This model has particular educational value because it highlights a distinction that is often implicit in technical projects: understanding the problem and producing the solution are two distinct activities. A student may be able to develop a feature without having verified whether it meets the relevant need. Similarly, an apparently interesting idea may require further exploration before it can be selected.

Divergence helps prevent premature closure of the problem or the solution. In the discovery phase, it encourages the search for different information and the examination of multiple interpretations. In the development phase, it encourages the generation of several avenues rather than immediately settling on the first idea. Convergence, on the other hand, involves a reasoned selection: students must determine which information is relevant, which problem warrants addressing, and which solution should be explored further.

However, the Double Diamond should not be understood as a rigid or strictly linear process. Testing may reveal a misunderstanding of needs, a prototype may uncover a new constraint, and information received, later on, may lead to reformulating the problem. The model therefore serves as a framework for guidance and reflection, rather than a sequence of steps that precludes any backtracking.

In this research, the Double Diamond is used on two levels. From an educational perspective, it structures the activities offered to students. From an analytical perspective, it allows us to organize the data collected and examine the skills employed in each phase. This dual function constitutes one of the central themes of the article.

- *Training Engineers for the 21st Century: From Technical Expertise to Human Skills*

Engineering education has traditionally aimed to develop scientific knowledge, technical skills, and the ability to design systems that meet explicit constraints. Contemporary professional challenges, however, also require an understanding of the social, organizational, and human dimensions of technical systems.

Dym et al. (2005) emphasizes the importance of developing design thinking in engineering education. Learning should not merely impart knowledge that enables the analysis of existing systems; it must also prepare students to design, experiment with, evaluate, and justify solutions.

Human-centered design adds to this approach the requirement to take into account the people involved and their contexts of use. The ISO 9241-210 standard (ISO, 2019) proposes principles aimed at integrating human needs into the life cycle of interactive systems. In particular, it emphasizes understanding the context of use, user participation, solution evaluation, and iteration.

In a computer science course, these principles can transform the way a project is approached. Rather than starting immediately with a list of features, students are encouraged to explore the situations in which the product will be used. They must identify the stakeholders involved, understand the tasks to be performed, and pinpoint obstacles that could influence the user experience.

This approach draws on several complementary skills: observation, interpretation, problem formulation, creativity, experimentation, and evaluation. It does not replace technical knowledge; rather, it helps direct the application of that knowledge toward clearly defined needs and better-understood usage scenarios.

The Double Diamond framework allows these skills to be integrated into a clear educational progression. The discovery and definition phases, in particular, call for observation and problem formulation. The development phase involves exploring solutions and creativity. The delivery phase entails evaluating, revising, and justifying decisions. This makes it possible to link learning objectives to identifiable activities and deliverables.

Teaching UX Design to computer science students does not, therefore, necessarily mean training them to become designers. The goal is to provide them with a design mindset that enriches their technical expertise and prepares them to collaborate with users, designers, and other professionals.

- *Generative Artificial Intelligence: Automation of Production and the Need for Judgment*

Generative artificial intelligence is transforming the conditions under which students can produce code, text, scenarios, or interface proposals. It can facilitate the exploration of variations and reduce the time required for certain tasks. However, the quantity or fluidity of outputs does not guarantee their relevance.

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Dwivedi et al. (2023) and Kasneci et al. (2023) highlight the potential of generative AI in professional and educational practices, while also emphasizing the challenges of reliability, verification, and accountability.

In UX design, AI can assist in generating ideas, suggesting interview questions, helping to structure information, or generating interface variations. However, an automatically generated persona does not constitute evidence regarding a real user. A plausible scenario may overlook important constraints. A visually compelling interface may still be ill-suited to observed practices.

The use of AI must, therefore, be evaluated based on the phase of the Double Diamond process in which it is applied. During the discovery phase, it can help prepare for research but does not replace the collection of real data. During the definition phase, it can suggest summaries or formulations, but these must be cross-checked against available information. During the development phase, it can expand the range of possibilities and contribute to the creation of prototypes. During the delivery phase, it can help analyze feedback or suggest improvements, without replacing user validation.

This approach allows AI to be viewed as a cross-functional tool rather than as an additional phase in the model. The key question then becomes the quality of the reasoning behind its use: Are the proposals verified? Do students identify unsupported elements? Can they explain why a suggestion was accepted, modified, or rejected?

The expected competency is, therefore, not limited to the operational use of AI. It includes the ability to maintain the distinction between data, hypotheses, and generated content, as well as to take responsibility for final decisions.

- *Conceptual Framework: The Double Diamond as a Tool for Analyzing Competencies*

Building on this research, this article proposes to examine the reconfiguration of engineers' competencies through four dimensions corresponding to the phases of the Double Diamond.

The first concerns understanding uses. It is based on the ability to observe, question, and interpret the situations in which a digital product will be used.

The second dimension focuses on problem formulation. It involves the ability to synthesize information, distinguish between needs and proposed solutions, and formulating a well-reasoned design problem.

The third dimension concerns exploration and experimentation. It involves generating ideas, comparing proposals, prototyping, and revising choices.

The fourth dimension focuses on evaluation and decision-making responsibility. It involves the ability to test solutions, analyze feedback, justify decisions, and verify proposals generated by AI.

These dimensions are not considered independent skills or ones that are automatically acquired. They constitute an analytical framework for examining students' activities, interactions, and work products.

The general hypothesis is as follows:

Teaching UX design, structured around the Double Diamond framework, can help broaden the skill set of future engineers by integrating an understanding of user needs, problem formulation, solution experimentation, and critical judgment within an AI-assisted design environment.

This hypothesis must be examined using empirical data. It does not presuppose that all students will adopt this approach, nor that the model will necessarily produce the same effects in all contexts.

III. METHODOLOGY: AN EXPLORATORY QUALITATIVE STUDY IN AN EDUCATIONAL CONTEXT

- *Research Framework*

This study adopts an exploratory qualitative approach aimed at understanding how UX Design instruction fits into the education of computer science students and what forms of reasoning and design can be observed during the learning process.

The study focuses on the design processes implemented by students, the interactions observed, and the work products created. It prioritizes the analysis of situations and traces of work rather than relying exclusively on retrospective statements.

The Double Diamond serves as the organizational framework for the analysis. It allows for structuring the observation around four phases, while still allowing for the identification of backtracking, difficulties, or practices that do not exactly correspond to the model's theoretical progression.

- *Field Site and Participants*

The fieldwork took place at the École Supérieure Privée d'Ingénierie et de Technologies (ESPRIT) in Tunisia during the 2025–2026 academic year. The study focused on a 21-hour UX Design/UX Design Thinking module taught during the first period of the first semester to fourth-year computer science students.

Students are enrolled in web development tracks, designated TWIN, and mobile development tracks, designated SIM. The module introduces a user-centered design approach within a program primarily focused on computer science and software development.

The analysis focuses on teaching practices, observed interactions, and student work produced during the module. The exact number of participants and teams represented in the corpus will be specified based on the data actually selected for the analysis.

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➢ *Pedagogical Organization: The Four Phases of the Double Diamond*

The module uses the Double Diamond model to structure the design process. The four phases—discover, define, develop, and deliver—serve as the guiding framework for the pedagogical activities.

- *Phase 1: Discover—Observe and Understand*

The discovery phase aims to explore the initial situation and understand the users involved. It primarily involves information gathering, observation, and user interviews.

The educational objective is to encourage students to temporarily set aside formulating a solution in order to examine the context and needs. The interviews and information gathered should enable them to move beyond their initial assumptions.

Documents associated with this phase include interview guides, research notes, collected information, and analyses. Reviewing these documents allows us to examine how students distinguish between observed data and their interpretations.

- *Phase 2: Define—Formulate the Problem*

The definition phase involves synthesizing the information gathered and identifying a specific design problem. Students can use personas, usage scenarios, and interview summaries to organize their understanding of the situation.

The goal is to transform a relatively open-ended exploration into a problem statement precise enough to guide the design. This phase is a critical point in the process, as an insufficiently substantiated formulation can lead to the development of a solution that addresses a poorly identified need.

The analysis therefore focuses on the relationship between the collected data, the representations produced, and the chosen problem statement.

- *Phase 3: Develop—Explore and Prototype*

The development phase opens up a new space for exploration. Based on the defined problem, students generate ideas, compare proposals, and build prototypes.

The goal is to help students understand that an initial idea is not necessarily the best solution. Bringing proposals to life makes hypotheses visible, allows for discussion, and prepares the ground for their evaluation.

The analyzed records include the ideas generated, scenarios, prototypes, and—when successive versions are available—the modifications made to the proposals.

- *Phase 4: Deliver—Test, Refine, and Prepare for Implementation*

The delivery phase involves evaluating and refining the selected solution. Testing and user feedback may reveal challenges, lead to modifications of the prototype, or, in some cases, require a reevaluation of the problem definition.

This phase should not be viewed as merely a final formalization. It allows for verifying the extent to which the proposals meet the identified needs and for examining the students' ability to revise their decisions.

The analysis focuses on the tests conducted, the documented feedback, the adjustments made, and the associated justifications.

The Double Diamond thus provides a common pedagogical and analytical framework. It organizes activities without imposing a strictly linear progression: it is still possible to go back and forth between phases when information or evaluations lead to a decision being reconsidered.

➢ *The Cross-cutting Role of Generative Artificial Intelligence*

Generative AI is viewed as a resource that can be used at various stages of the process, rather than as a distinct phase of the Double Diamond.

Its use can be examined through four questions: What task does it address? At what point in the process does it come into play? How do students verify its suggestions? What decisions do they make as a result of using it?

During the discovery phase, the analysis focuses on the distinction between research preparation and the actual collection of information from users. During the definition phase, it examines the relationship between AI-assisted summaries and available data. During the development phase, it focuses on the generation and transformation of ideas or prototypes. During the delivery phase, it examines how suggestions for improvement are evaluated against user feedback.

This approach aims to distinguish productive assistance from critical judgment. It does not assume that AI was used in exactly the same way by all students. The specific tools and uses must be determined based on available observations and records.

➢ *Corpus Construction and Data Collection*

The corpus is based on two main categories of materials: observations of instructional situations and student work.

The observations focus on work practices, interactions among team members, discussions regarding design choices, and observable behaviors during the various phases. They aim to document how students approach tasks, organize their work, discuss their hypotheses, and respond to the constraints they encounter.

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Student work includes, in particular, user interviews and their analysis, personas, usage scenarios, and prototypes. These allow us to examine how information is selected, interpreted, and translated into design decisions.

When corresponding records are available, interactions with AI tools can also be included in the corpus: queries entered, suggestions generated, corrections made, and decisions taken. In the absence of a history or comparable versions, it is not possible to attribute an idea or decision with certainty to the use of AI.

Linking these different sources allows for methodological triangulation. Observations can be cross-referenced with tangible outputs, while documents can help interpret the decisions made during the sessions.

➢ *Method of Analysis*

Qualitative analysis is structured around the four phases of the Double Diamond. First, the data are classified according to their relationship to discovery, definition, development, or delivery. Second, they are examined to identify observable activities, challenges, choices, and changes. Third, the empirical categories are linked to the competencies under study and the theoretical works drawn upon.

The analysis remains open to phenomena that do not conform to the expected model. A team may, for example, return to user research during prototyping, or produce a solution before having sufficiently defined the problem. These deviations should not be excluded from the analysis: they may reveal difficulties in adopting the process or specific design strategies.

For each interpretation, it is advisable to maintain an identifiable record: an observation note, an excerpt from the output, a comparison of versions, or a documented interaction. If multiple people participate in the analysis, the categories and interpretation criteria must be explicitly stated and compared. If the analysis is conducted by a single person, this limitation must be noted.

- *Ethical Considerations and Methodological Limitations*

This research focuses on students in an educational setting. Data must be handled in accordance with confidentiality, personal data protection, and the institution's ethical guidelines. Student work must be anonymized when necessary, and personal information collected during interviews must be protected.

The study's specific context constitutes a significant limitation. The analysis of a 21-hour module at a particular institution does not allow for the direct generalization of conclusions to all engineering programs. Furthermore, without pre- and post-assessments of skills or a comparative framework, it would be difficult to attribute any observed changes exclusively to UX Design instruction.

Finally, the use of AI can only be analyzed accurately if the available records document the tasks involved and the decisions made. The conclusions must, therefore, be proportionate to the data actually collected.

IV. RESULTS AND ANALYSIS: AN INTERPRETATION OF THE DESIGN PROCESS THROUGH THE DOUBLE DIAMOND

➢ *Note on Scientific Rigor:*

The following four subsections outline the analysis to be conducted based on the corpus. They do not constitute confirmed empirical results until specific examples drawn from observations and student work have been incorporated into them. The wording must be adjusted to reflect the facts that have actually been documented.

➢ *Discovery: Understanding Usages Before Proposing a Solution*

The first dimension of analysis concerns how students explore the initial situation and gather information about users. In an IT project, it can be tempting to immediately translate a request into features. The discovery phase introduces a period of investigation that allows students to question their initial assumptions and better understand the context of use.

User interviews provide an initial record of this activity. Their analysis may focus on the nature of the questions asked, the relevance of the information gathered, and the ability to identify needs that extend beyond the solutions already envisioned. It is also important to examine whether students distinguish between users' statements and their own interpretations.

This distinction is important when AI tools are used to prepare for research or suggest questions. Such assistance can help structure an interview guide, but it does not replace actual exchanges with users. A description generated by AI does not constitute observational data.

Analyzing discovery traces thus allows us to study students' ability to recognize uncertainty, gather information, and postpone a design decision until the problem is better understood.

➢ *Defining: Transforming Information into a Design Problem*

The second dimension concerns the transition from exploration to problem formulation. Students must organize the information they have gathered, identify needs, and formulate a problem statement that can guide the design process.

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Personas, usage scenarios, and interview summaries can be examined as tools for this transformation. Their relevance depends on the relationship between their content and the available data. A visually well-presented persona is not necessarily based on solid research; conversely, a simpler summary may be relevant if it clearly articulates the observed needs and constraints.

The analysis must also examine how students select information. Are contradictory elements taken into account? Are needs distinguished from the proposed features? Is the chosen problem statement justified by the collected data?

In the context of generative AI, it is important to examine whether the formulations or summaries proposed by the tools are verified and appropriate. The problem definition must remain grounded in the available information, even when AI helps organize or rephrase that information.

- *Develop: Explore Solutions and Test Hypotheses*

The third dimension involves exploring solutions and prototyping. The Double Diamond framework encourages students to consider multiple avenues before selecting a direction. This divergent approach can be examined through the ideas generated, the variations explored, and the reasons for selecting certain proposals.

The prototype then makes it possible to bring a design hypothesis to life. It makes the choices visible and allows for discussion of their consistency with the defined problem. The analysis should not be limited to the prototype's appearance or level of polish; it must also consider its functional relevance and its connection to the identified needs.

The use of generative AI can increase the number of proposals generated or accelerate the creation of variations. However, the diversity of proposals does not guarantee their quality. It is necessary to examine how students evaluate the generated results, what modifications they make, and to what extent their decisions remain consistent with the data from the discovery phase.

Successive versions of the prototypes serve as particularly useful records in this context. They can help identify the changes made, the reasons behind them, and the information that prompted them.

- *Deliver: Test, Evaluate, and Revise Solutions*

The fourth dimension concerns the evaluation of proposals. Testing allows the prototype to be put through its paces in real-world scenarios and helps identify difficulties that may not be apparent during the design phase.

The analysis can focus on how students prepare for tests, gather feedback, and determine what changes to make. A test is not merely a final validation step: it can challenge a hypothesis, reveal a need that was not sufficiently addressed, or lead to revisiting an earlier phase.

This ability to backtrack is essential for understanding the Double Diamond as an iterative framework rather than a rigid sequence of steps. A solution may require returning to the problem definition—or even to user research—when evaluation results reveal a significant discrepancy.

AI can help organize feedback or suggest improvements, but these suggestions must be weighed against the findings from the tests. The final decision must be justified by the identified needs, the results obtained, and the project's constraints.

This phase therefore allows us to assess students' ability to evaluate their own proposals, accept revisions, and distinguish between the polish of an interface and its actual relevance.

- *Cross-Cutting Synthesis: Critical Judgment in an AI-Assisted Process*

The four phases of the Double Diamond provide a framework for structuring the analysis, but the role of AI must be examined across all phases. Its role is not limited to a specific stage: it can be involved in research, problem formulation, solution exploration, and evaluation.

The analysis identifies three exploratory configurations. In the first, AI is used to generate proposals and accelerate certain tasks. In the second, outputs are compared, verified, adapted, or rejected based on the data and design objectives. In the third, proposals are adopted without sufficient verification and risk, replacing the analysis of usage patterns.

These configurations should not be considered results until they have been identified in the data. They constitute a coding framework intended to make the observed uses comparable.

The central issue is maintaining the designer's judgment. The student must be able to explain why a proposal was selected, what information supports it, and what limitations remain. The quality of the work thus depends not only on what is produced, but also on how decisions are formulated and justified.

V. DISCUSSION: THE DOUBLE DIAMOND AS A BRIDGE BETWEEN ENGINEERING, HUMAN EXPERIENCE, AND ARTIFICIAL INTELLIGENCE

- *Highlighting the Distinction Between a Problem and a Solution*

The primary contribution of the Double Diamond is to highlight the distinction between understanding a problem and developing a solution. In technical projects, the temptation to move quickly to implementation can lead to taking the initial definition of the need for granted.

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By structuring the process around discovery and definition, the Double Diamond provides a framework for challenging this tendency. It encourages us to view user research and problem formulation as activities in their own right, rather than as optional preliminary steps.

This perspective aligns with Buchanan (1992) and Dorst (2011), who highlight the importance of framing and reframing in design problems. It also helps connect the UX approach to the requirements of engineering education: technical skills become more relevant when they are applied to address a problem that has been sufficiently understood.

The contribution of this article is, therefore, not to assert that the Double Diamond guarantees better design. Rather, it proposes a framework for examining whether teaching the Double Diamond helps students distinguish between the different steps of the process and justify their decisions.

- *The Double Diamond as a Pedagogical Framework for Learning*

The model offers a clear progression for students: explore, define, develop, and evaluate. This structure makes it easier to articulate instructional objectives and allows activities to be linked to identifiable outcomes.

The discovery phase can be linked to observation and analysis skills. The definition phase involves synthesis and problem formulation. The development phase calls for exploration and prototyping. The delivery phase involves evaluation and revision.

This correspondence allows the instructor to specify what is expected at each phase and to design appropriate assessment criteria. However, it does not mean that each skill is exclusively engaged in a single phase. Observation may continue during testing, problem formulation may evolve during prototyping, and evaluation may influence the entire process.

The Double Diamond should, therefore, be used as a tool for structuring and reflection, not as a rigid framework that imposes an unchangeable sequence.

- *Generative AI as a Cross-cutting Tool in the Double Diamond*

The integration of generative AI prompts us to examine how automated generation fits into the design process. These tools can facilitate exploration, but they can also produce proposals that appear coherent without being sufficiently grounded in data.

The discovery phase reminds us that user research requires real-world information. The definition phase shows that the problem statement must remain consistent with the available data. The development phase allows us to take advantage of the generation of variants, while the delivery phase requires us to test the proposals against user feedback.

The Double Diamond framework thus allows us to ask a question that goes beyond the mere effectiveness of the tools: At what point and under what conditions does AI assistance contribute to the designer's reasoning, and at what point does it risk replacing a necessary design activity?

To answer this question, the analysis must examine interactions and decisions rather than merely noting the presence of AI. In particular, it must document the generated proposals, the checks performed, the modifications made, and the reasons for the final choice.

- *Rethinking the Teacher's Role and Assessment*

The Double Diamond framework can also support an evolution in teaching practices. The instructor does not merely convey a method or validate a deliverable. Instead, they guide students in understanding user needs, formulating problems, and evaluating proposals.

In an environment where AI can rapidly generate content and interfaces, evaluating only the final result is no longer sufficient. A successful interface does not necessarily prove that students have understood the users or that they have been able to justify their decisions.

Assessment can therefore take several elements into account: the quality of user research, the consistency between the data and the problem statement, the diversity of approaches explored, the relevance of the prototypes, the use of feedback, and the justification for the use of AI.

Such an approach requires making the criteria explicit from the start of the project. Students must know what forms of assistance are permitted, how to document their use of AI, and what responsibilities they bear. These conditions are necessary for collaboration with AI to become a learning experience rather than merely a means of streamlining production.

- *Toward Engineering that is Attentive to the Human Experience*

The integration of the Double Diamond and UX Design leads to a broader conception of the engineer's role. Engineers remain responsible for the technical quality of the systems they develop, but their work must also take into account the people and environments in which these systems are used.

The Double Diamond provides a framework for integrating this focus into the design process. It encourages observing before drawing conclusions, defining before developing, exploring before selecting, and evaluating before considering a solution complete.

In an environment shaped by generative AI, this process discipline becomes particularly relevant. The ability to rapidly produce a solution does not eliminate the need to verify that it meets a real need. On the contrary, the ease of generation can make it even more important to question proposals, justify decisions, and accept their consequences.

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This proposal remains a hypothesis to be tested against observations. Nevertheless, it suggests a direction for engineering education: to develop, in tandem, the ability to produce technically feasible solutions and the ability to examine why, for whom, and under what conditions these solutions should be designed.

VI. LIMITATIONS AND PROSPECTS

This research has several limitations. The first concerns the specific nature of the fieldwork: the study focuses on a 21-hour module taught at a particular institution to fourth-year computer science students. The observations cannot be directly generalized to other educational contexts.

The second limitation concerns the duration of the program. A short module allows for the introduction of an approach and the observation of certain practices, but is not necessarily sufficient to bring about a lasting transformation of professional competencies.

The third limitation concerns the attribution of effects. Without pre- and post-measurements, without comparison to another program, or without longitudinal follow-up, it is difficult to assert that the observed changes result exclusively from instruction in the Double Diamond or UX Design.

The fourth limitation concerns the use of AI. A precise analysis requires records that identify the tools used, the tasks involved, and the decisions made in response to the generated proposals. In the absence of this information, conclusions must remain cautious.

Finally, the proposed analytical framework must be tested against the reality of the dataset. The four phases of the Double Diamond provide a structure, but the observed practices may be nonlinear, incomplete, or different from pedagogical expectations.

Several avenues could extend this work. One would involve analyzing successive versions of the student's work to identify changes in the problem statement, personas, and prototypes. A second would aim to systematically document interactions with AI to distinguish between generative, reflective, and insufficiently controlled uses. A third would involve comparing multiple groups or pedagogical approaches, taking into account students' prior knowledge.

A longitudinal study could also examine whether the skills developed in the module are applied to other computer science projects or in students' early professional experiences.

VII. CONCLUSION

Generative artificial intelligence is transforming the way digital solutions are developed and calls for a rethinking of the skills taught in engineering programs. While these tools can facilitate the generation of code, text, and interface proposals, they do not guarantee that the resulting solutions will meet the needs of the people involved.

This article examines the role of UX Design in this evolution based on a pedagogical experiment conducted at ESPRIT with fourth-year computer science students. The integration of the Double Diamond framework structures this analysis into four phases: discover, define, develop, and deliver.

The model highlights the distinction between understanding the problem and producing the solution. It also allows each phase to be linked to activities and records that can be analyzed: user research, problem formulation, solution exploration, prototyping, and evaluation. Generative AI can be studied across these phases by examining how its proposals are verified, modified, or rejected.

The central contribution of this work is to propose an analytical framework for studying how a human-centered design approach can be integrated into the technical training of engineers in an AI-assisted environment. The aim is not to view the Double Diamond as a guarantee of learning, but rather as a pedagogical and analytical tool whose effects must be documented. From this perspective, teaching UX design is not merely about imparting tools for creating interfaces. It also involves teaching future engineers to observe, interpret, identify problems, experiment, and evaluate. The challenge is to preserve the designer's responsibility in a context where solutions can be produced more quickly, but where their human relevance remains to be examined.

The question, therefore, is not about choosing between the engineer, the designer, and artificial intelligence. It is about understanding how their contributions can be integrated without confusing generation with design, plausibility with validity, or automation with responsibility. The Double Diamond offers a framework for exploring this integration and for examining how engineering education programs can prepare professionals capable of designing not only functional systems but also solutions that are relevant to the people who use them.

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