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Visualizing the Engineering Design Process: Analyzing Visual Representations from K-12 Educators

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Visualizing the Engineering Design Process: Analyzing Visual Representations from K-12 Educators

Abstract

This study examines perceptions and understandings that K-12 educators have of the Engineering Design Process (EDP) through the analysis of visual representations submitted during a collaborative workshop survey. Teachers were asked to illustrate or describe their interpretation of the EDP, providing insights into how they conceptualize and implement the process in diverse classroom settings. The collected visual data revealed a broad range of interpretations, which spanned from linear step-by-step sequences to more dynamic iterative loops. A systematic coding and thematic analysis of these visual submissions was conducted to identify key themes, such as variations of the iterative nature of the EDP, differences in the complexity and number of stages, and specific contextual elements, such as resource constraints or student diversity, that may shape implementation practices.

This analysis aims to help inform how teachers conceptualize and plan for implementation of the EDP in their classrooms, providing insights into their unique educational contexts and experiences with engineering practices. The findings will highlight the importance of providing differentiated professional development and resources to better support teachers in effectively integrating the EDP into their curricula. By examining how educators visualize and conceptualize the EDP, this research contributes to a deeper understanding of the practical challenges and opportunities in teaching engineering practices in K-12 education. Moreover, it bridges critical gaps in understanding how current educator practices influence student learning outcomes. It also aims to provide evidence-based recommendations for curriculum developers, teacher educators, and policymakers to enhance the support and training offered to K-12 teachers.

Introduction

The Engineering Design Process (EDP) serves as a cornerstone in engineering education, providing a systematic framework for problem-solving, innovation, and iterative refinement. In recent years, its integration into K-12 education has gained momentum, aiming to equip students with critical thinking, creativity, and collaboration skills [1][2]. By introducing the EDP at early educational levels, educators can prepare students to approach real-world challenges with a mindset grounded in engineering practices.

As educators strive to implement the EDP effectively, visual representations of the process have emerged as essential tools for communication and instruction. These visuals help translate abstract concepts into concrete stages that are accessible to diverse learners [3]. However, such representations vary significantly in style, complexity, and alignment with educational standards, reflecting the influence of classroom-specific factors such as time limitations, subject matter constraints, or access to training resources. For instance, linear models often dominate in K-12 classrooms due to their simplicity, while iterative or hybrid models, though more reflective of authentic engineering practices, are less frequently employed [4].

The variability in how educators conceptualize and visualize the EDP raises important questions about its impact on teaching and learning outcomes. Previous studies have highlighted that inconsistent or incomplete representations can hinder students' understanding of the iterative nature of engineering design [5]. Moreover, the gaps in how educators are trained and supported to use the EDP remain a critical issue, limiting the effective translation of engineering principles into classroom practices. Educators' interpretations of the EDP are shaped by their experiences, teaching contexts, and exposure to formal training, leading to a spectrum of practices that may not always align with standard models [6].

This study examines 40 visual representations of the EDP collected during a collaborative workshop with K-12 educators. Participants were asked to draw or describe their interpretation of the EDP, offering insights into their perceptions, priorities, and contextual adaptations of the process. Through a systematic analysis of these representations, this research seeks to identify patterns in how the EDP is visualized and conceptualized, focusing on key factors such as structural components, process flow, thematic concepts, and educational contexts. Examples of these visualizations, such as flowcharts or iterative diagrams, illustrate how different levels of abstraction and clarity can influence their effectiveness in diverse classroom settings.

The analysis employs a mixed-methods approach, combining systematic coding and symbols analysis to explore both quantitative trends and qualitative nuances. Key aspects examined include the presence and organization of EDP stages (e.g., define, ideate, prototype, test, evaluate), the representation style (e.g., linear, iterative, hybrid), and the inclusion of contextual factors such as classroom constraints and student-centric practices. Additionally, the study investigates how these visualizations align with pedagogical frameworks and standard models of the EDP, with particular attention to adaptations for K-12 settings.

Understanding these patterns is critical for enhancing the design and use of EDP visualizations in educational practice. By identifying common trends and potential gaps, this research aims to provide actionable insights for educators, curriculum developers, and policymakers. Ultimately, the findings contribute to a broader understanding of how the EDP can be effectively represented and taught, fostering meaningful learning experiences that prepare students for the challenges of engineering and beyond.

Background

The EDP serves as a structured way to approach problem-solving in engineering education. Various models have been developed, each offering a unique approach to teaching design thinking, demonstrating that the EDP is inherently flexible and adaptable to different contexts rather than adhering to a single, uniform structure. Atman et al. compare the design processes of students and expert engineers, highlighting critical differences such as experts' greater emphasis on comprehensive problem scoping, iterative feedback, and refinement [7]. Hynes et al. propose a high school EDP model that incorporates steps like identifying the problem, researching, developing solutions, and iterative prototyping, emphasizing non-linear navigation that mirrors real-world engineering challenges (see Figure 1)[6].

Dorie et al. explore early childhood design thinking, analyzing models like the Engineering is Elementary (EiE) framework, which simplifies the process into "Ask, Imagine, Plan, Create, Improve" for younger learners [4]. This simplification underscores the importance of developmental appropriateness in EDP models, ensuring accessibility for younger students while maintaining essential design principles. These studies collectively illustrate how EDP models can vary in complexity and structure, tailoring their stages to meet the developmental and contextual needs of learners. Despite these variations, core elements- such as defining the problem, fostering iteration, and engaging in evaluative processes - remain consistent across models, reflecting the universal principles of engineering design.

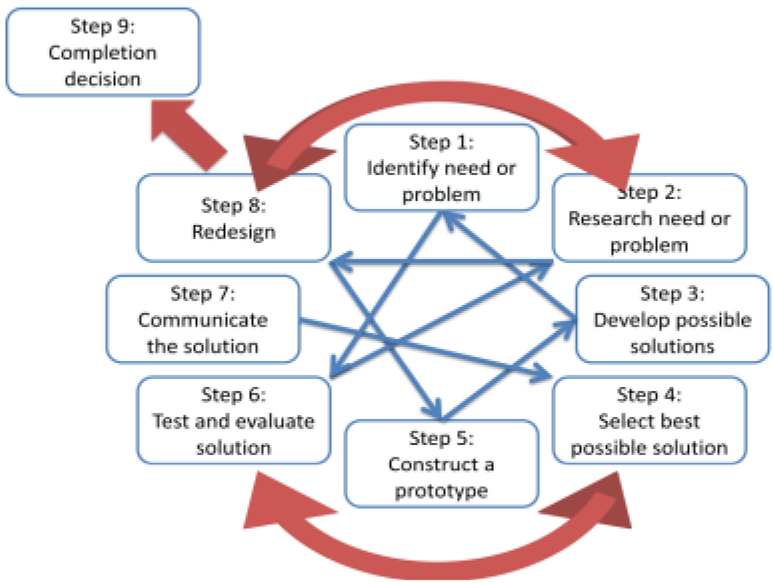


Figure 1: Example of EDP (Hynes et al., 2011)

Methodology

This study utilizes a mixed-methods approach to analyze the visual and textual representations of the EDP submitted by K-12 educators. By integrating both quantitative and qualitative methodologies, the study achieves a comprehensive and nuanced exploration of the data. The analysis is organized around four core dimensions: structural components, thematic concepts, educational and pedagogical context, and visual analysis. These dimensions are strategically selected to capture multifaceted ways in which educators conceptualize and apply the EDP.

Structural components focus on the presence and organization of key EDP stages, while thematic concepts explore broader trends and contextual factors including constraints or student-specific considerations. The educational and pedagogical context dimension examines how classroom settings and instructional practices shape these representations. Finally, the visual analysis delves into the stylistic and semiotic elements of the diagrams, such as the use of flowcharts, feedback loops, or creative metaphors, to assess clarity and pedagogical coherence.

This systematic coding framework ensures that variations in representation styles are accounted for, while thematic analysis captures deeper insights into contextual influences. By combining both quantitative coding of trends and qualitative interpretation of unique patterns, this approach provides a balanced examination of both widespread and nuanced elements. Ultimately, this methodology enables the study to link educators' conceptualizations of the EDP with practical implications for curriculum development and instructional design.

Data Collection

The dataset consists of 40 sheets collected from K-12 educators during a collaborative workshop. Each sheet reflects the educator's interpretation of the EDP, presented in various formats, including drawings, flowcharts, diagrams, or written descriptions. Educators were prompted to respond to the question, "*What does the engineering design process mean to you? (draw or describe)*" (See Figure 1). The diverse formats - ranging from simplified linear sequences to complex, iterative models - highlight educators' varied levels of familiarity and engagement with the EDP. This diversity offers valuable insights into educators' conceptualizations of the process and the contextual factors shaping their perspectives. All participants provided informed consent, and the study was conducted in accordance with institutional ethical guidelines. Participant anonymity was maintained by de-identifying the artifacts prior to analysis, thereby protecting individual privacy and confidentiality throughout the research process.

The participants involved in this study represent a diverse demographic profile, contributing to the richness of the data collected. The grade levels of participants span across elementary, middle, and high school, with the majority associated with 6th grade and 7th grade. In terms of age distribution, the majority fall within the 45 to 54 age group (32.7%), followed by 35 to 44 (30.9%) and 25 to 34 (21.8%), with smaller groups in 18 to 24 (9.1%) and 55 to 64 (5.5%). Regarding sex, the participants were predominantly Female (85.2%), reflecting broader trends in K-12 education, with Male participants accounting for 14.8%. This demographic diversity allows for a comprehensive exploration of how varied teaching contexts, levels of experience, and personal perspectives influence educators' conceptualizations of the EDP. These demographic factors play a critical role in shaping both the content and style of the visual and textual responses, providing a nuanced understanding of the factors influencing EDP implementation in K-12 education.

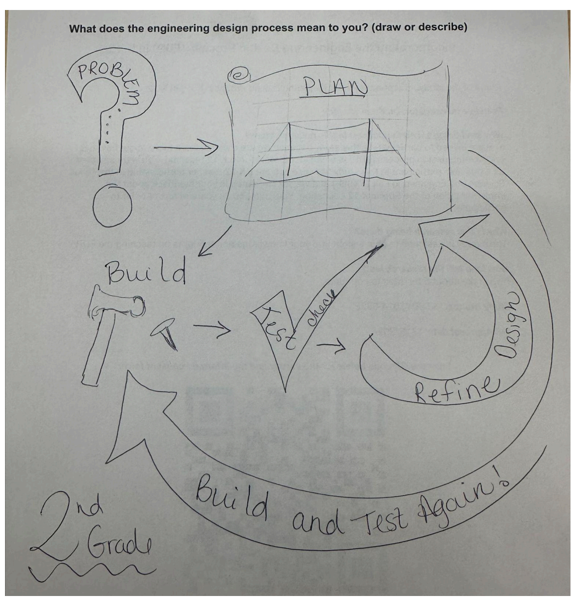


Figure 2. Example of EDP representation

Data Analysis

The data analysis process employed a mixed-methods approach to examine the visual and textual representations of the EDP submitted by K-12 educators in a comprehensive manner. This approach was designed to balance the identification of overarching trends with an in-depth exploration of unique patterns within the dataset. This analysis was guided by three primary dimensions: structural components, thematic concepts, and visual characteristics, providing a comprehensive framework to capture both the quantitative trends and qualitative nuances within the dataset.

Structural components focused on the presence and organization of key EDP stages, such as *Identify Problem* and *Create and Test.* Each representation was coded to identify the number and type of stages included, as well as the complexity of descriptions. Complexity was classified as either simple (e.g., single-word labels like "Plan") or detailed (e.g., multi-word explanations such as "Develop a prototype for testing design solutions"). Process flows were categorized into four types: linear, iterative, hybrid, or nonlinear, based on the directional patterns and feedback mechanisms depicted in the visualizations. Representation styles, including the use of arrows and symbols, were analyzed to assess clarity and organizational coherence.

Thematic analysis was conducted to explore broader trends and contextual influences embedded in the data. This included identifying explicit evidence of iteration, such as explicit feedback loops and refinement processes. Additionally, the analysis explored contextual factors, such as specific classroom constraints (e.g., time, resources) and subject-specific adaptations, that were evident in the educators' representations of the EDP.

Visual analysis delved into the semiotic and stylistic elements of the diagrams. Each visual representation was categorized into one of three types: flowcharts, textual descriptions, or creative drawings. Symbols and metaphors, such as lightbulbs for ideation or gears for collaboration, were noted for their consistency and coherence. In cases where textual descriptions were used, the analysis evaluated how effectively they conveyed the EDP stages compared to more visually oriented approaches. This layer of analysis emphasized the interplay between form and function, assessing how stylistic choices impacted comprehension and applicability.

By combining systematic coding, thematic exploration, and visual analysis, this study ensured a multidimensional understanding of the dataset that captured both commonalities and contextual variations. These findings enabled the identification of key patterns, gaps, and areas for potential improvement in educators' conceptualizations and visualizations of the EDP. As a result, the study provides actionable insights for enhancing professional development, ensuring that educators are better equipped to integrate the EDP into diverse classroom settings.

Results

Stages Analysis

The analysis of stages in the EDP, as represented in Table 1, reveals significant insights into how K-12 educators conceptualize and implement the engineering design process in their classrooms. Each stage demonstrates distinct patterns in frequency, terminology, and emphasis, offering a nuanced understanding of educators' interpretations and priorities of the EDP.

Problem Definition emerged as a critical stage, referenced in 19 instances with terms such as "Idea," "Question," "Identify," and "Problem." This stage was widely recognized as foundational, setting the trajectory for the entire EDP by aligning subsequent stages with real-world challenges. However, the emphasis tended to skew toward identifying the problem rather than deeply defining it, indicating an opportunity to strengthen educators' focus on refining problem statements for clarity and relevance.

Ideation appeared less frequently, mentioned in only 9 instances, with terms like "Research," "Brainstorm," "Imagine," and "Generate Ideas." This stage encourages creativity and the exploration of diverse potential solutions, but its relatively low frequency indicates a gap in fostering divergent thinking. This underrepresentation points to a need for training that emphasizes idea generation, creative exploration, and the value of fostering innovative thinking in engineering education.

Planning was referenced 12 times, consistently using terms such as "Plan" and "Draw." The prominence of this stage highlights educators' recognition of the need for structured preparation before moving into action. Planning ensures that resources are organized, constraints are identified, and clear steps are outlined to address the problem effectively. Its consistent inclusion underscores its perceived importance in creating a roadmap for successful implementation.

Creation/Development was the most frequently mentioned stage, appearing in 20 instances with terms such as "Create," "Design," "Build," "Develop," and "Propose Solution." This stage reflects the hands-on, practical aspects of engineering, where ideas are transformed into tangible prototypes or solutions. The varied terminology highlights the flexibility of this stage, showing how educators adapt it to diverse classroom scenarios and instructional goals.

Testing was emphasized in 15 instances, commonly labeled as "Test" or "Try." This stage underscores the importance of validating solutions to ensure they meet the defined criteria. However, while "Testing" was a frequently mentioned component, explicit references to Evaluation were rare. This suggests a potential gap in recognizing evaluation as a broader, more iterative process that includes analyzing outcomes, identifying areas for improvement, and ensuring alignment with overarching goals.

Iteration/Improvement was the least frequently mentioned stage, appearing in only 8 instances, with terms like "Refine," "Redesign," and "Modify." While its inclusion demonstrates an awareness of the iterative nature of engineering design, its lower frequency highlights a conceptual gap. Educators could benefit from additional support to view iteration not just as a stage, but as a dynamic, continuous process essential for innovation and improvement.

Table 1. Frequency and Characteristics of EDP Stages

Stage	Frequency (Instances)	Common Labels/Terms	Key Insights
Problem Definition	19	"Idea", "Question", "Identify" "Ask," "Problem"	Emphasized as the foundational stage of the EDP. Critical for aligning subsequent stages with real-world challenges. The emphasis skewed toward identifying rather than deeply defining the problem, highlighting a training gap in problem refinement.
Ideation	9	"Research," "Brainstorm," "Imagine," "Generate Ideas"	Encourages creativity and exploration of potential solutions. Lower frequency suggests a gap in fostering divergent thinking and the importance of idea generation, necessitating targeted professional development.
Planning	12	"Plan," "Draw"	Highlights the importance of structured preparation. Consistently included to organize resources, identify constraints, and outline clear steps.
Creation/ Development	20	"Create," "Design," "Build," "Develop," "Propose Solution"	Reflects hands-on, practical aspects of engineering. Varied terminology suggests flexibility and adaptability to different classroom contexts.
Testing	15	"Test," "Try"	"Test" was frequently mentioned as a stage but often limited to basic testing without deeper evaluation. Rare explicit mention of Evaluation highlights a potential gap in broader assessment practices, including analysis and refinement.
Iteration/ Improvement	8	"Refine," "Redesign," "Modify"	Demonstrates some awareness of the iterative nature of engineering design. Lower frequency indicates a need for more emphasis on iteration as a dynamic, ongoing process critical for innovation and refinement.

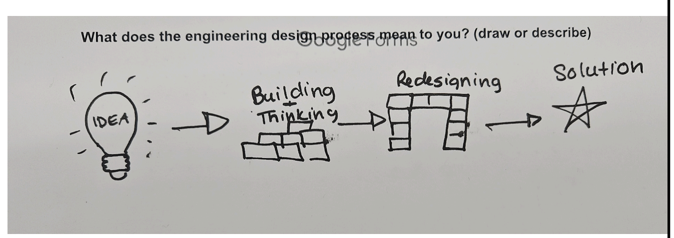
Visual Analysis

The visual representations of the EDP took various forms, including hand-drawn diagrams, flowcharts, textual descriptions, and hybrid combinations of these elements. Approximately 60% of participants utilized flow charts or diagrams to organize their ideas, 25% relied on textual descriptions, and 15% used creative drawings or metaphors. These diverse approaches highlight differing levels of comfort and familiarity with visualizing abstract processes, underscoring the variability in how educators translate engineering concepts into instructional tools.

Contextual influences, such as classroom constraints and subject-specific adaptations were evident in several representations. However, student-centric practices—including collaboration, teamwork, and explicit roles for students in the design process—were depicted in only 10% of the diagrams. This highlights a potential gap in understanding how the EDP can support collaborative learning environments, emphasizing the need for professional development that integrates teamwork and social learning strategies into engineering tasks.

Process flows were categorized into four types: linear, iterative, hybrid, or nonlinear (See Table 2). While many visuals captured the iterative nature of the EDP through feedback loops, some representations omitted this critical aspect, highlighting a need for targeted professional development on the importance of iteration in engineering design. A trade-off between simplicity and conceptual depth was also observed. Simpler diagrams were easier for students to understand but often omitted essential stages or concepts, potentially limiting their ability to grasp the iterative and dynamic aspects of the EDP. Hybrid and circular process flows, which closely resemble real-world engineering practices, were well-represented and may better prepare students for authentic problem-solving scenarios. In contrast, linear flows, though easier to follow, may oversimplify the design process and limit students' understanding of the iterative and non-linear nature of engineering tasks.

Table 2. Descriptions of EDP Representation Types

<table>
<tr><th>Flow Categories</th><th>Description</th><th>Example</th></tr>
<tr><td>Linear</td><td>A sequential process where stages occur one after the other without feedback loops or repetition.</td><td>
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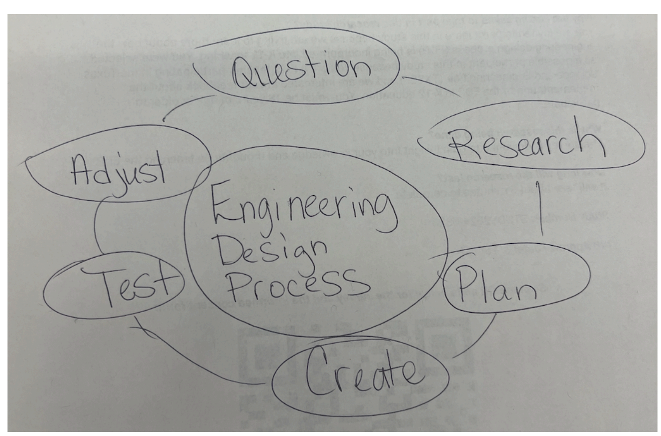
<tr><td>Iterative</td><td>A circular process that loops back to the first step, emphasizing continuous improvement and refinement.</td><td>
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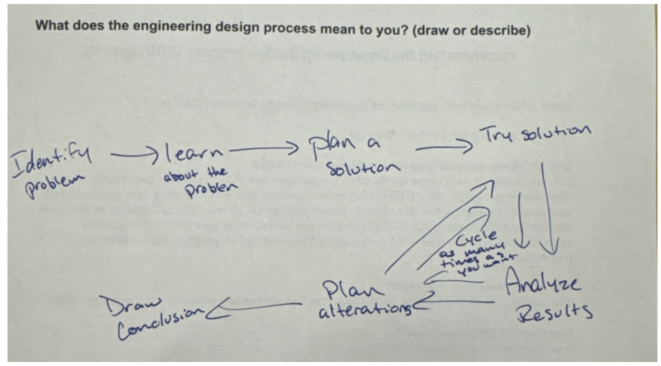
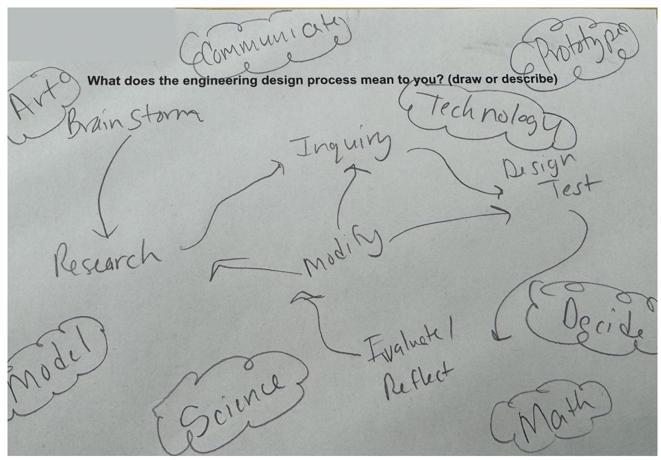
Hybrid	A combination of linear and iterative elements, with some stages sequential and others including feedback loops.	
Nonlinear	A dynamic and flexible model where stages are interconnected without a defined starting or ending point.	

The visual analysis revealed a strong preference among most educators for structured diagrams, such as flowcharts, with approximately 60% of participants opting for this format. Text-heavy descriptions used by 25% of participants, provided detailed explanations but often often lacked visual clarity and ease of comprehension. A smaller group (15%) utilized creative drawings or metaphors, while engaging, and varied in their effectiveness due to inconsistent symbolism. Symbolic consistency was notable in 75% of the diagrams, where arrows and directional cues guided the process flow effectively. However, the use of metaphors—such as lightbulbs for ideation or gears for collaboration—was observed in only 20% of the visuals. These symbols, though powerful in enhancing comprehension, suffered from inconsistent application, which undermined their potential impact.

Content Analysis

The open-ended responses reveal several key themes about participants' understanding of the EDP. A prominent theme across responses is the emphasis on *creativity and innovation*. Many participants describe the EDP as a process of creating something new or unique. For example, one participant refers to the process as "creating something from nothing," highlighting its connection to innovation and critical thinking. Similarly, another response contrasts "cookie-cutter activities" with inquiry-based projects that yield diverse outcomes, showcasing the importance of fostering creativity through open-ended problem-solving.

Another recurring theme is the *problem-solving orientation* of the EDP. Nearly all responses emphasize the EDP's problem-solving nature, framing it as a structured framework for identifying and resolving challenges. One participant explains it as "finding the problem then working towards a solution," while another describes it as "finding the best solution to a problem." This shared focus on addressing challenges demonstrates that participants view the EDP as a systematic approach to tackling complex, real-world issues.

The *iterative nature* of the EDP also features prominently in several responses. Many participants emphasized the importance of testing, refining, and improving designs. One respondent explicitly discusses "many different prototypes and trials" and acknowledges that finding a solution often involves "many failed attempts." Another highlight "repeating the process until a design is complete." This recognition highlights the role of iteration in fostering resilience, persistence, and a growth mindset. However, while iteration was commonly referenced, fewer responses explicitly addressed the role of feedback mechanisms, indicating a potential area for professional development.

Several responses highlight the *hands-on and practical aspects* of the EDP, reflecting its experiential nature. One participant mentions "spending more time hands-on," while another connects the process to "applying science and math to real-world situations." This focus on practical application aligns well with the goals of engineering education, which prioritize engaging students in active learning and real-world problem-solving. Additionally, *visualization and modeling* emerge as important elements in the responses. One participant describes the EDP as a "visual or actual model" of work, emphasizing its role in organizing and structuring the process. This understanding reflects the dual nature of the EDP as both a conceptual framework and a tangible guide for facilitating action.

While the responses reflect a strong foundational understanding of the EDP, some areas for development remain. Few participants explicitly mention collaboration, which is a critical component of engineering practices. Similarly, while iteration is commonly referenced, the role of feedback in refining designs is less frequently addressed. Encouraging participants to consider teamwork and feedback as integral to the EDP could provide a more holistic understanding. Additionally, while some responses connect the EDP to real-world applications, others focus narrowly on its iterative and creative aspects. Expanding discussions to emphasize the EDP's broader relevance and transferability could further deepen understanding.

Key Findings

The results reveal notable variations in how educators perceive and implement the EDP. While many representations align with established models, inconsistencies in the inclusion of iterative stages and evaluation suggest a need for enhanced professional development. Contextual factors, such as classroom constraints and subject-specific adaptations, heavily influence educators' visualizations, reflecting their practical teaching environments.

Some representations emphasize collaboration and teamwork, which align with modern pedagogical trends and highlight the importance of student-centric practices in engineering education. The findings indicate opportunities for targeted training to emphasize student-centric practices, standardized resources, and iterative processes. These insights hold implications for curriculum developers, teacher educators, and policymakers, highlighting the need to provide educators with resources that promote consistency, clarity, and the ability to adapt the EDP effectively to classroom challenges.

Discussion

Interpretation of Findings

The visual and descriptive representations of the EDP from K-12 educators reveal substantial variations in how the process is conceptualized and communicated. These variations range from simplified linear sequences to complex iterative models, reflecting diverse interpretations influenced by educators' experiences, teaching contexts, and prior exposure to formal EDP training. In contrast, iterative and hybrid models demonstrate a more accurate understanding of the cyclical refinement inherent in engineering challenges.

The variability in the stages, terminology, and flow structures reflects differences in educators' familiarity with the EDP. Participants with exposure to professional development or practical application often incorporated iterative and evaluative components, whereas others prioritized problem identification or testing, potentially due to limited training. This highlights the importance of professional development that emphasizes a comprehensive approach to the EDP, including overlooked elements like feedback-driven iteration and collaboration.

These differences impact how students engage with the EDP. For example, a focus on testing and iteration fosters continuous improvement, while creativity and brainstorming encourage innovative thinking. However, gaps in collaboration and teamwork point to opportunities for targeted training that aligns the EDP with real-world engineering practices. Additionally, the low frequency of feedback mechanisms indicates a need to strengthen educators' ability to integrate iterative feedback into classroom instruction.

Educational Implications

Educator representations often align with core EDP elements like Create and Test, but gaps in defining constraints, evaluating solutions, and fostering collaboration suggest a need for deeper understanding. Professional development programs must emphasize the EDP's cyclical and iterative nature, equipping educators to visualize and adapt the process effectively. Resources should include successful classroom adaptations and differentiated visual tools that balance clarity with conceptual depth. These efforts will ensure the EDP is presented as a flexible framework that meets diverse classroom needs without compromising its core principles.

Recommendations

1. **Enhancing EDP Training Programs:** Teacher training should explicitly cover all stages of the EDP, ensuring alignment with established models. Emphasis should be placed on iterative practices, refining designs, and the evaluation of solutions. Workshops could include hands-on activities where educators create and critique EDP representations, fostering a deeper understanding of the process.
2. **Promoting Collaboration and Student-Centric Practices:** Training programs should encourage educators to incorporate teamwork and collaborative problem-solving into their EDP

representations and classroom activities. Highlighting real-world engineering projects that rely on collaboration can reinforce the importance of teamwork. By doing so, educators can help students develop both technical and interpersonal skills essential for engineering.

3. **Addressing Contextual Adaptations:** Recognizing the influence of classroom constraints, teacher training should include strategies for adapting the EDP to different subjects and resources. Sharing best practices and success stories from peers in similar teaching contexts can enhance educators' confidence and creativity in implementing the EDP.
4. **Classroom Implementation Strategies:** Encourage educators to use examples and case studies to connect the EDP stages with real-world applications, fostering student engagement and practical understanding. This approach can foster student engagement by demonstrating the relevance of engineering design to everyday life and diverse career paths.

Broader Impacts

This study contributes to the growing body of research on pre-college engineering education by shedding light on how educators perceive and teach the EDP. The findings emphasize the critical need for targeted professional development and adaptable teaching resources that bridge gaps in iterative, evaluative, and collaborative practices. By addressing these gaps, educators can better prepare students for real-world engineering challenges and foster critical thinking, creativity, and problem-solving skills.

For curriculum developers, this means creating resources that balance theoretical rigor with practical applicability. For teacher educators, the focus should be on designing programs that integrate foundational knowledge with hands-on classroom strategies. Policymakers play a key role by embedding EDP-focused training into teacher certification and professional development initiatives. Collectively, these efforts can create a more cohesive and impactful approach to integrating the EDP into K-12 education, ensuring alignment with modern engineering practices.

Limitations

While the dataset offers rich insights into K-12 educators' perceptions of the EDP, the findings may not fully generalize to broader educational contexts. The interpretations are influenced by the specific workshop setting including its collaborative nature and the educators' varying levels of prior exposure to EDP frameworks. Additionally, since the data collection was limited to a single workshop, contextual factors such as regional educational policies and available resources may have affected the representations, potentially limiting the broader applicability of the results.

Conclusion

This study provides a nuanced exploration of how K-12 educators perceive and represent the EDP, uncovering both promising practices and significant areas for growth. While foundational stages such as Identify, Create, and Test were well-represented across most visualizations, critical aspects like iteration, evaluation, and collaboration were less consistently included. These gaps highlight opportunities for enhanced professional development and targeted interventions to better equip educators with the skills and understanding necessary for effective EDP integration. Future research should include longitudinal studies on the impact of professional development initiatives and cross-disciplinary perspectives to explore how different contexts influence EDP implementation. By continuing to refine and enhance EDP teaching practices, educators can inspire the next generation of students to approach real-world challenges with ingenuity, resilience, and a design-oriented mindset.

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