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PathwayAI: Leveraging AI and Gamification to Support First-year Engineering Student Learning and Personal Development

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Abstract:

This evidence-based complete paper introduces PathwayAI, a gamified, web-based assessment platform designed to support students' personal and professional development through sustained reflective practice and formative feedback. First-year engineering courses play a fundamental role in shaping students' engagement, self-efficacy, and potential professional identities. However, assessment practices in these courses often prioritize technical performance, offering limited insight into students' reflective growth, motivation, and sense of belonging in engineering.

Grounded in theories of reflective learning and formative assessment, PathwayAI integrates biweekly structured reflective prompts with low-stakes gamified elements, including progression indicators, personalized ability word clouds, and visualized growth dashboards. The platform is designed to translate abstract developmental outcomes, such as metacognitive awareness, confidence, and professional identity, into interpretable indicators for students, while providing instructors with aggregated analytics that highlight patterns in engagement and reflection. The conceptual design of PathwayAI emphasizes the role of students' reflection and supportive learning environments in early professional identity formation instead of assessment.

This formative, exploratory study examines the implementation of PathwayAI in a first-year engineering context through qualitative thematic analysis of student reflection data collected during a small pilot. The study is guided by two research questions: (1) how engagement with PathwayAI relates to students' self-reported sense of self-efficacy and belonging in engineering, and (2) how students' reflective writings demonstrate metacognitive awareness and personal growth over time.

Findings suggest that the gamified reflective pathway supported sustained engagement and encouraged deeper metacognitive reflection, with students frequently articulating increased awareness of learning strategies and professional identity development. This work contributes an early-stage, scalable model for integrating gamification, reflective assessment, and AI-supported learning analytics in engineering education, reframing assessment as a collaborative and reflective process rather than solely a performance measure.

Keywords: Engineering Education, Artificial Intelligence, Gamification, Reflective Practice

1. Introduction

Assessing the development of professional competencies in undergraduate engineering education remains a persistent and unresolved challenge. While technical knowledge can be evaluated through examinations, problem sets, and laboratory reports, competencies such as professional identity formation, ethical reasoning, adaptability, self-regulation, and a sense of belonging in engineering are more difficult to measure in consistent and meaningful ways. These qualities are widely recognized as essential outcomes of engineering education [1], yet they often remain implicit, inferred indirectly, or evaluated only at the end of a course through surveys or reflective essays that provide limited insight into students' developmental trajectories [2].

This challenge is particularly pronounced in the first year of engineering programs. First-year students often experience a period of transition characterized by heightened academic expectations, unfamiliar learning environments, and shifts in personal responsibility [3]. Current engineering education research has shown that this transition can involve cognitive, motivational, and identity-related disruptions, all of which influence students' persistence and engagement in engineering [4]. However, even though first-year engineering courses are designed to support students' adjustment and introduce foundational professional competencies, instructors often lack practical tools to capture how students are developing these competencies or how specific course experiences contribute to students' sense of belonging in the discipline [5].

In response to the need for better assessment tools, reflective practice has been widely advocated as a means of making students' learning processes, professional reasoning, and identity development more visible [6]. Structured reflection allows students to articulate how they interpret their experiences, connect theory to practice, and make sense of challenges encountered in coursework and team-based projects [7]. From an assessment perspective, student reflections offer a direct window into professional thinking that cannot be accessed through traditional examinations alone. However, the effectiveness of reflective assessment depends critically on sustained student engagement. When reflections are infrequent, unstructured, or perceived as peripheral to the course, student participation is often superficial or inconsistent, limiting both their pedagogical value and their usefulness as assessment data.

In practice, sustaining meaningful engagement in reflective assessment at scale remains a central barrier. Traditional assessment approaches, such as end-of-semester reflection assignments or journaling logs [8], frequently fail to capture developmental continuity or to motivate regular participation. As a result, instructors are left without longitudinal evidence of students' professional growth, and students receive little feedback that helps them recognize or articulate their own development. Addressing this engagement problem is therefore essential for advancing assessment practices related to professional competencies and belonging in engineering education.

This project is trying to include gamification and artificial intelligence (AI) to offer new possibilities for addressing this challenge. Gamification has been shown to support sustained engagement by making abstract processes visible and progress tangible [9], while AI-enabled analytics can support the organization, synthesis, and visualization of large volumes of qualitative data [10]. Importantly, these technologies need not function as autonomous instructional agents. Instead, they can serve as infrastructure that supports theoretically grounded assessment designs by reducing instructor workload and scaling reflective data collection.

In response to these challenges and opportunities, this paper presents the design and exploratory pilot of PathwayAI, a gamified, AI-supported reflective assessment system developed for a first-year engineering context. PathwayAI is designed to capture students' biweekly reflections on their learning experiences, translate these reflections into visual indicators of professional development, and generate aggregated analytics that can inform instructional decision-making. The system emphasizes engagement through low-stakes, game-like progression while maintaining a clear separation between pedagogical intent and technological implementation: learning theory guides what is assessed, and the platform serves as a mechanism to sustain participation and scale analysis.

The purpose of this paper is not to evaluate the effectiveness of PathwayAI in improving learning outcomes. Rather, it reports on a design-informed exploratory pilot that examines the feasibility of using a gamified, AI-enabled pathway system to support metacognitively informed reflective assessment in first-year engineering. Specifically, the paper contributes (1) a design framework for sustained reflective assessment of professional competencies, (2) a detailed description of the operational mechanisms underlying PathwayAI, and (3) initial observations from a small pilot focused on student perceptions and implementation considerations. By foregrounding assessment design rather than technological novelty, this work aims to inform ongoing efforts to develop scalable, human-centered approaches to evaluating professional development and belonging in engineering education.

2. Conceptual Framework and Design Rationale

2.1 Professional Competencies, Belonging, and Reflective Assessment

Engineering education increasingly recognizes that professional competencies [11], such as ethical reasoning, teamwork, adaptability, self-regulation, and professional identity, are essential outcomes of undergraduate programs. Examinations and quizzes primarily capture technical knowledge, while project deliverables often conflate team dynamics, individual contributions, and technical outcomes, obscuring evidence of individual professional development.

Closely linked to these competencies is the construct of student belonging and professional identity. Students' sense of belonging in engineering is shaped by how they interpret their experiences, interactions, and perceived fit within the discipline. These constructs are inherently subjective and developmental, unfolding over time rather than manifesting as discrete, measurable outcomes. As a result, they are often assessed through end-of-course surveys or retrospective reflections that provide limited insight into students' evolving perspectives.

These competencies have been emphasized by accreditation bodies and employers alike [12], yet they remain difficult to assess using traditional evaluation methods [13]. To bridge this gap between implicit developmental processes and explicit assessment, reflective practice offers a unique and necessary mechanism. Through structured reflection, students articulate their reasoning, make sense of experiences, and connect course activities to broader professional goals. From an assessment standpoint, reflection provides direct evidence of students' thinking processes and identity development that cannot be inferred from performance metrics alone. However, reflection as an assessment method presents its own challenges: without structure, continuity, and meaningful incentives, reflective activities frequently result in superficial or inconsistent participation.

2.2 Sustaining Engagement: Gamification as Assessment Infrastructure

The central challenge in reflective assessment is maintaining student engagement over time. While students may initially participate in reflective activities, motivation often declines when reflections are perceived as repetitive, disconnected from course outcomes, or low-value relative to other graded work. This engagement problem limits both the pedagogical impact of reflection and its usefulness as a source of longitudinal assessment data.

Gamification offers a mechanism for addressing this challenge by embedding reflective activities within a motivational structure that emphasizes progress, visibility, and continuity. To ensure this structure fosters genuine engagement rather than superficial compliance, we draw on Self-Determination Theory (SDT) [14]. SDT posits that intrinsic motivation is sustained when experiences support the basic psychological needs of "autonomy", "competence", and "relatedness" [15].

In this context, gamification is not intended to promote competition or extrinsic rewards, but rather to make abstract developmental processes tangible and observable. Specifically, the platform supports competence through visual indicators of progress, such as milestones and evolving representations of growth, which help students recognize reflection as an ongoing process rather than an isolated task. Simultaneously, it fosters autonomy by allowing students to customize their avatars and engage with personalized ability word clouds, thereby supporting their agency in defining their professional identity. Finally, the system addresses relatedness by connecting individual reflections to the broader engineering framework, cultivating a sense of belonging and fulfilling the need for connection within the field.

When applied thoughtfully, gamification can function as an assessment infrastructure, supporting sustained participation without altering the underlying pedagogical intent. By linking reflective engagement to visible indicators of growth, gamified systems can encourage consistency while preserving the formative and introspective nature of reflective practice.

2.3 Design Principle: Separating Pedagogy from Technology

To operationalize this distinction, a guiding principle in the design of PathwayAI is the explicit separation between pedagogical theory and technological implementation. Learning theory determines what is assessed, how prompts are structured, and how student development is conceptualized. Technology, by contrast, functions as a delivery, organization, and visualization mechanism that supports scale and sustainability.

Specifically, in this work, metacognitive learning principles inform the design of reflective prompts, emphasizing planning, monitoring, and evaluation of learning experiences. These principles were established prior to platform development and are independent of the AI system itself. PathwayAI does not generate pedagogical content or determine learning objectives; instead, it organizes, sequences, and presents human-designed reflective assessments in a way that supports regular engagement.

This separation is critical for avoiding overreliance on AI as an autonomous instructional agent and for maintaining transparency in assessment practices. By positioning AI as a support mechanism rather than a decision-maker, the system preserves instructor agency and ensures that assessment remains grounded in established educational theory.

3. PathwayAI System Design

3.1 System Overview

PathwayAI is a gamified web-based platform designed to support students' sustained reflective assessment in engineering education. The system serves three purposes: (1) to provide students with structured opportunities for reflection and formative feedback, (2) to sustain engagement through low-stakes gamified progression, and (3) to provide instructors with aggregated analytics summarizing patterns in engagement and reflective themes.

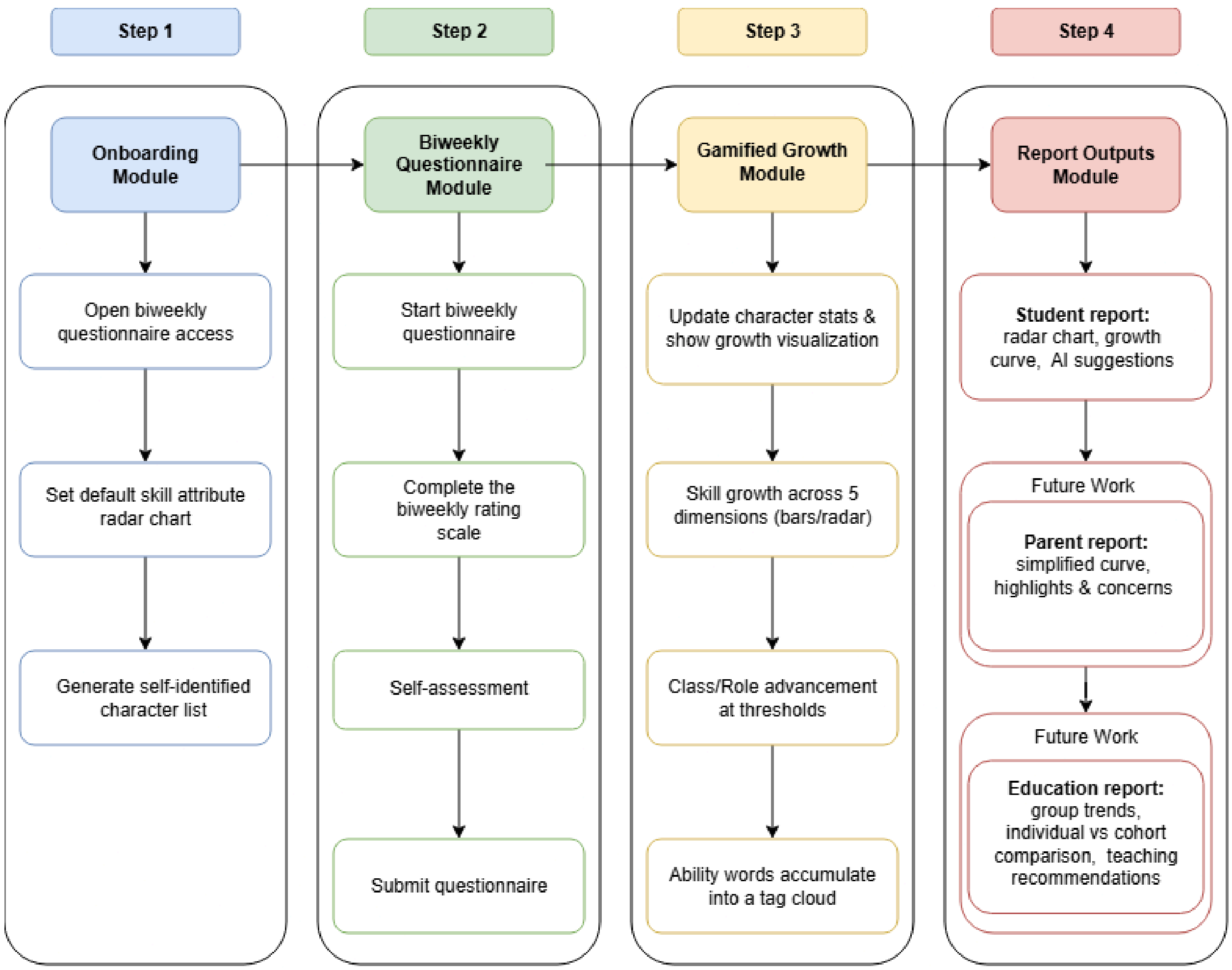

Figure 1. Workflow of PathwayAI

In this figure, the colored columns represent individual steps in the process, moving from left to right. The blue column represents Step 1, the Onboarding Module, in which students will initialize their profile and attributes. Step 2, represented by the green column, is where students will complete the Biweekly Questionnaire Module. Step 3, represented by the yellow column, is where student data will be utilized to create skill visualizations in the Gamified Growth Module. The final step of this process, represented by the red column, is where the Report Outputs Module will create visual reports and AI insights for the various parties involved. The arrows in each column represent the order in which the tasks occur in each step of this process.

PathwayAI captures biweekly student reflections, processes these data through an AI-augmented analytics engine, and presents outcomes through visual and textual representations. The PathwayAI design and workflow are shown above in Figure 1. These representations are designed to be interpretable by both students and instructors, supporting self-awareness at the individual level and instructional responsiveness at the course level.

The interaction design of PathwayAI's user interface aims to reduce the operational burden of students' participation in reflective assessment by embedding reflective activities within a workflow that is understandable and traceable, as shown in Fig. 2. Students begin with a login and profile/dashboard interface [Fig. 2(a)], where they can manage personal information, review completed survey records, and identify pending reflective tasks in a single location, thereby establishing a stable and predictable usage rhythm. By selecting the "Take the Survey" button, students proceed to the current week's structured biweekly questionnaire [Fig. 2(b)] and complete rating-scale items and open-ended responses related to recent learning experiences. After survey submission, the system presents a feedback interface [Fig. 2(c) in the Appendix A] that displays an engineering character archetype, a baseline competency radar chart, and longitudinal competency trends, thereby translating reflective responses into interpretable developmental cues for students and instructors.

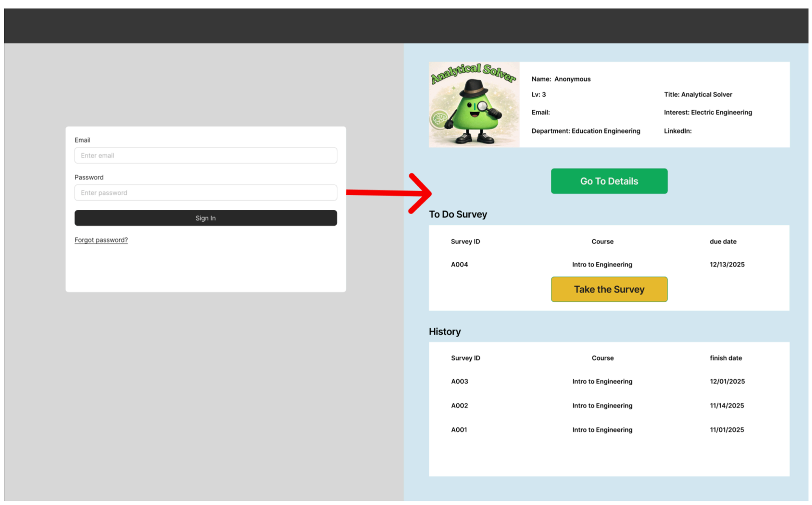

Fig. 2(a) Student login and profile/dashboard interface

Fig. 2(a) PathwayAI user interface workflow. (a) Login and profile/dashboard interface, where students manage account information, review survey history, and access pending biweekly reflection tasks.

At the system level, PathwayAI adopts a modular design to support the continuity and scalability of reflective assessment (Figure 1). The "Onboarding Module" assists students in establishing an initial professional development baseline by translating abstract engineering competencies and identity recognition into a concrete starting state. The "Biweekly Questionnaire Module" provides a periodic, low-burden reflective mechanism that enables students to gradually build awareness of their learning and growth throughout the course. Subsequently, the "Gamified Growth Module" uses AI-supported analysis to translate reflective data into visual representations of competency change and character development, while the “Report Outputs Module” organizes these results into summary forms interpretable by both students and instructional staff.

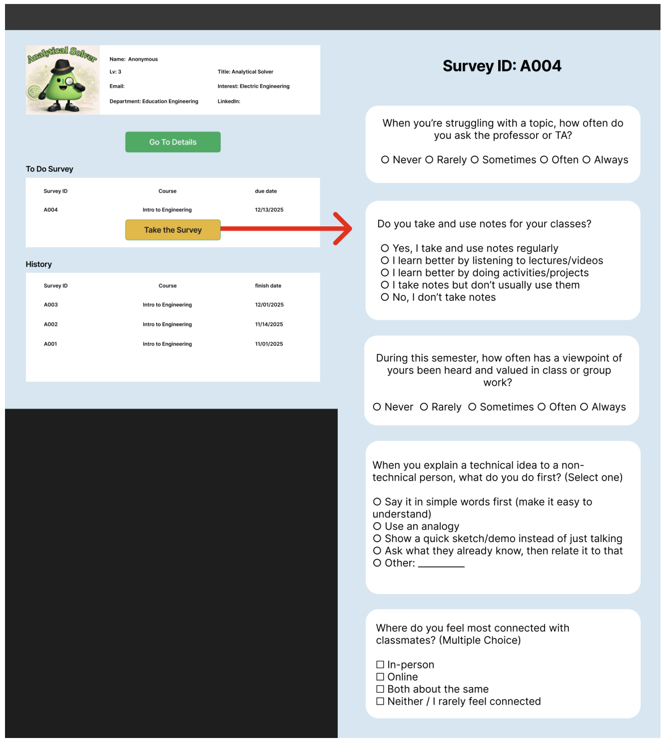

Fig. 2(b) Biweekly reflective questionnaire and self-assessment interface

Fig. 2 (b) Biweekly questionnaire interface with structured reflective prompts and self-assessment items designed to capture students’ learning experiences and professional development.

3.2 Onboarding Module: Establishing the Professional Baseline

The onboarding module serves as the initial entry point for students, focusing on the construction of a digital representation of their emerging professional identity. This stage is critical for moving beyond decorative gamification toward a metaphor-driven reflection process.

Avatar Creation and Identity Metaphor: Upon their first login, each student creates a customizable avatar. In the context of PathwayAI, this avatar is not merely a graphical element but functions as a dynamic metaphor for the student’s professional journey in engineering.

Competency Assessment: Students complete an initial self-assessment focused on five foundational engineering dimensions: teamwork, communication, problem-solving, critical thinking, and self-management.

Initial Visualization (Radar Chart): The data from this baseline assessment is used to set the "starting attributes" of the student's skill attribute radar chart. This provides students with an immediate, personalized visualization of their perceived strengths and areas for growth as they enter the first year engineering course (course identifier withheld for review).

Character List Generation: Based on their initial profile, the system generates a self-identified character list, which anchors the gamified experience in the student's own professional aspirations.

3.3 Biweekly Questionnaire Module: Capturing Reflective Data

The Biweekly Questionnaire Module is the core data collection component of the system, designed to transform routine course experiences into structured reflective evidence.

Structured Reflection Access: Each fortnight, students access a new reflection prompt within the platform. This consistent delivery is intended to foster the sustained student engagement identified as a primary challenge in the literature.

Open-Ended Feedback: Students first complete a biweekly rating scale to provide quantitative self-reports on their progress. This is followed by short open-ended reflections where students describe specific experiences, such as team-based projects or laboratory challenges.

Self-Assessment Integration: Within the biweekly flow, students perform a micro-self-assessment, which allows the system to track subtle shifts in their confidence or perceived competence in real-time.

Data Submission and Processing: Once the questionnaire is submitted, the data is routed to the analysis component, which begins the process of updating the student's competence profile and generating "ability words" that reflect their developing identity.

3.4 Gamified Reflection Architecture

The core of PathwayAI is a gamified reflection architecture that embeds reflective practice within a coherent progression framework. Upon onboarding, students create a customizable avatar that represents their personal engineering journey. This avatar functions as a metaphor for professional identity development rather than as a competitive or performance-based character, which motivates students to consistently write their feedback to the PathwayAI. Our systems focus on five fundamental competencies [13] to summarize students' comprehensive abilities. Those five fundamental engineering competencies are Teamwork, Communication, Problem-Solving, Critical Thinking, and Self-Management. The PathwayAI system conducts a Core Competency Weighting Analysis based on those five key dimensions. By analyzing the proportional distribution of these competencies required for various engineering roles, PathwayAI provides students with personalized feedback on their ideal engineering character alignment. The core weight analysis of engineering characters is shown in Table 1 as follows.

To operationalize the gamified growth module, PathwayAI employs a weighted attribute modeling framework that links student reflections to ten distinct Engineer Character Archetypes. Rather than promoting a singular, monolithic definition of an engineer, this framework acknowledges diverse professional identities by analyzing student inputs across five core competencies: Teamwork (TW), Communication (COM), Problem-Solving (PS), Critical Thinking (CT), and Self-Management (SM).

Each archetype is defined by a unique "competency fingerprint", a specific distribution of weights that reflects the primary focus of that role. For instance, a student whose reflections consistently highlight the synthesis of disparate ideas and cross-functional collaboration would be identified as a "Systems Integrator." The algorithm assigns this archetype a high weight in Teamwork (0.35) and Problem-Solving (0.25), reflecting a role that focuses on "connecting components and people." In contrast, a student who focuses deeply on logic, data modeling, and root-cause analysis would evolve into an "Analytical Solver," a profile heavily weighted towards Problem-Solving (0.45) and Critical Thinking (0.30) but with a different emphasis than the integrator.

Table 1. Character Archetypes and Weighted Attribute

Engineer Character (Role)	Teamwork (TW)	Communication (COM)	Problem-Solving (PS)	Critical Thinking (CT)	Self-Management (SM)	Core Weighted Analysis
Systems Integrator	0.35	0.15	0.25	0.2	0.05	TW, PS
Architecture Thinker	0.05	0.15	0.3	0.45	0.05	CT, PS
Analytical Solver	0.05	0.05	0.45	0.3	0.15	PS, CT
Innovative Prototyper	0.05	0.25	0.4	0.2	0.1	PS, COM
Human-Centered Designer	0.25	0.4	0.1	0.2	0.05	COM, TW
Team Orchestrator	0.4	0.3	0.05	0.05	0.2	TW, COM, SM
Organized Executor	0.2	0.05	0.3	0.05	0.4	SM, PS
Risk & Ethics Guardian	0.05	0.1	0.15	0.5	0.2	CT, SM
Technical Communicator	0.1	0.4	0.25	0.2	0.05	COM, PS, CT
Efficiency Optimizer	0.05	0.05	0.35	0.3	0.25	PS, CT, SM

Other archetypes provide pathways for students with different strengths. A "Team Orchestrator" prioritizes Teamwork (0.40) and Communication (0.30), representing the essential role of aligning group efforts, while a "Risk & Ethics Guardian" emphasizes Critical Thinking (0.50) and Self-Management (0.20), validating the crucial contribution of foresight and ethical safety in engineering.

By mapping biweekly reflection data against these weighted profiles, the AI engine does not simply "grade" students but identifies their emerging professional style. This allows the system to generate dynamic, personalized feedback (e.g., the attribute radar chart) that is mathematically grounded in their actual reflective output, helping students visualize their specific contributions to the engineering field.

In addition, PathwayAI provides ten different engineering characters as feedback and guidance for students to understand their engineering competencies. This system provides students with a detailed and gamified engineering character over a semester to motivate students to build their engineering competencies, identities, and belongings. Figure 3 shows the ten different images of engineering characters for students in PathwayAI. There are some examples of engineering characters in PathwayAI in Appendix B for more details.

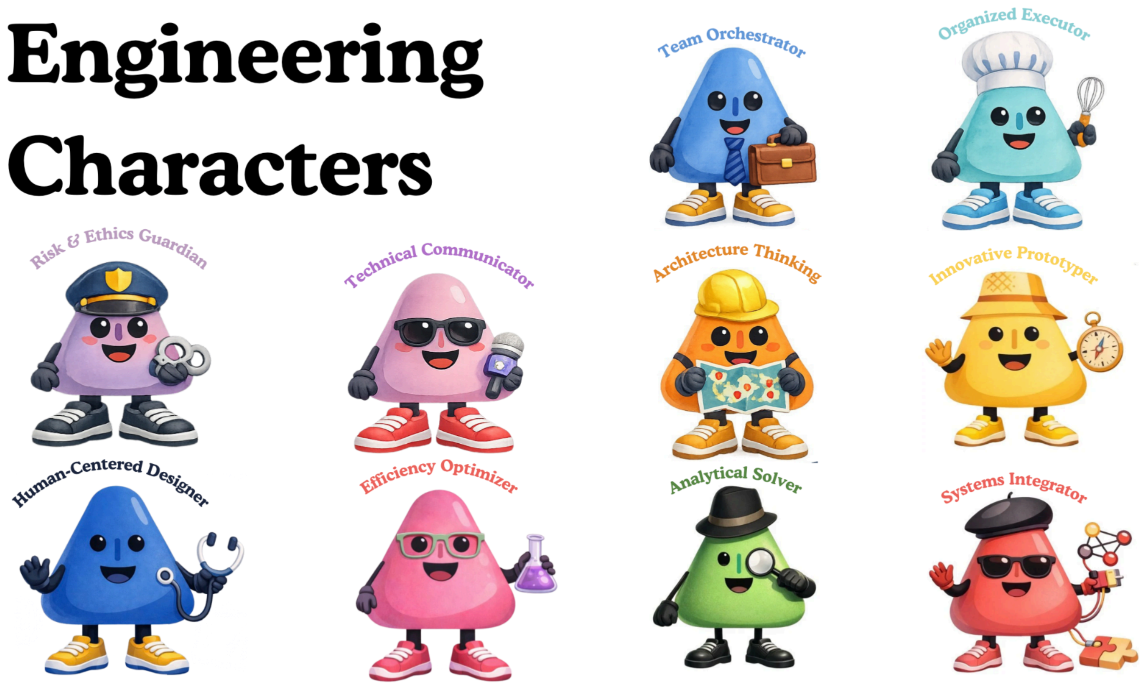

Figure 3. Ten Potential Engineering Characters

Each character represents a category to which students are assigned based on their survey results. The identification label of each character is displayed above the figure and matches the color scheme used in the design. Students can receive one of the ten possible character classifications after completing the survey biweekly.

3.5 AI-Supported Analytics and Feedback

The AI component of PathwayAI supports two primary functions: organization and synthesis. Natural language processing techniques are used to analyze student reflections, identify recurring themes, and update competence profiles across predefined dimensions (e.g., teamwork, communication, critical thinking).

Importantly, AI-generated outputs are designed to augment, not replace, human judgment. The system does not determine learning outcomes, assign grades, or make instructional decisions. Instead, it provides students with individualized feedback prompts and provides instructors with aggregated summaries that would be impractical to generate manually at scale.

The focus of this work is on the feasibility of using AI-enabled analytics to support theoretically grounded reflective assessment designs. Figure 4 shows one student's learning processes based on a pilot study. Figure 5 shows a radar chart over a semester in this pilot case.

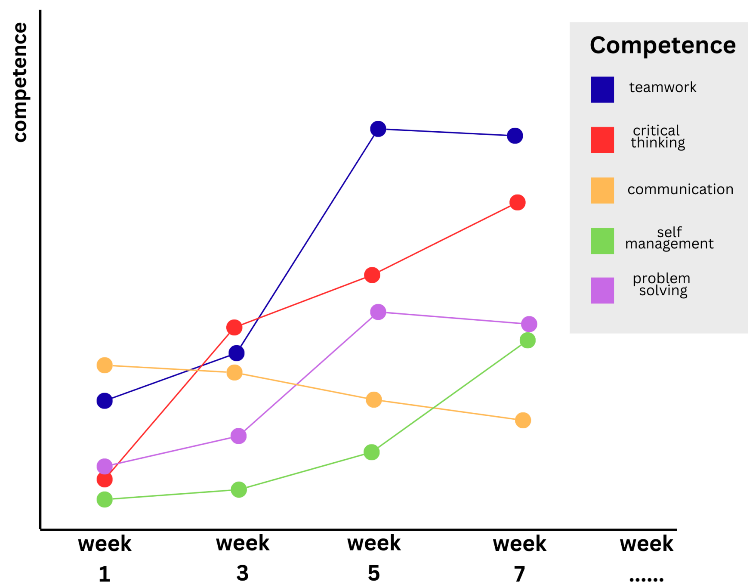

Figure 4. Growth Curve of Engineering Competence

This figure demonstrates the learning curves of five key competency dimensions over four weeks. Upward trends in teamwork, critical thinking, and problem solving indicate improvements in these areas, as does an increase in self-management skills (though communication skills have remained stable). These results demonstrate the ability of the PathwayAI platform to record improvements in various competencies over relatively short periods of time.

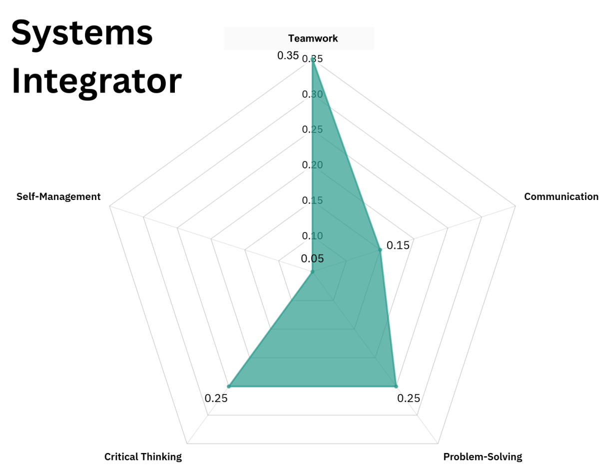

Figure 5. Radar Chart Example Bi-weekly (Systems Integrator)

This figure shows an example of the type of radar charts that will be provided for each student, on a bi-weekly basis, indicating the different skills that they have and how proficient they are. This can be performed throughout the semester to demonstrate which skills are improving and which need development.

PathwayAI integrates an engineering entrepreneurship mindset to deliver feedback and suggestions derived from the perspectives of CFY panel industrial stakeholders. Based on students' survey results, PathwayAI will also provide valuable suggestions regarding each student's radar chart and Growth Curve of Engineering Competence. No claims are made regarding AI-driven optimization of learning. PathwayAI connects with all of the Common First Year (CFY) panel discussions' transcripts from industrial stakeholders and alumni from each engineering department at UNC Charlotte to provide suggestions and learning opportunities for students.

These transcripts, comprising insights from industrial stakeholders, engineering department representatives, and alumni, serve as the primary data source for student guidance. Rather than providing generic academic advice, PathwayAI maps students' current competence profiles against the practical experiences and professional development milestones shared during these panels. This data-driven approach is designed to help students navigate engineering disciplines, build major selection confidence, and foster a stronger sense of professional belonging. PathwayAI provides feedback and suggestions from the CFY panel industry stakeholders' perspectives with an engineering entrepreneurship mindset.

4. Preliminary Findings from the Pilot Study

4.1 Implementation Context: First-year engineering course

PathwayAI was implemented within a first-year engineering course designed to introduce students to engineering practice, professional competencies, and strategies for academic success. The course plays a critical role in shaping students' early professional identity and sense of belonging in engineering.

The course was selected as a pilot context due to its emphasis on teamwork, project-based learning, and metacognitive reflection, as well as its medium enrollment size (40 students for each section) and multi-section structure among all engineering student cohorts. These characteristics make it well-suited for exploring scalable assessment approaches that can generate both individual and cohort-level insights of engineering students. This pilot study was conducted in accordance with the ethical standards of the Institutional Review Board (IRB) at UNC Charlotte (Protocol IRB-26-0537) for the survey data using.

Existing instructional materials were adapted rather than replaced. Biweekly reflective prompts were aligned with course activities and personal development goals, such as time management, teamwork experiences, and ethical considerations. The platform was delivered entirely online and integrated with the learning management system to streamline access and data collection.

4.2 Exploratory Pilot: Purpose, Scope, and Data Sources

The purpose of the exploratory pilot was to examine the feasibility, clarity, and perceived value of PathwayAI as a support mechanism for reflective assessment. The pilot was not designed to evaluate learning effectiveness, establish causal relationships, or generalize findings.

The pilot involved three first-year engineering students enrolled in the course. Data sources included biweekly reflective submissions, engagement logs within the platform, and informal student feedback regarding usability and perceived relevance.

Students reported that the structured nature of the reflective prompts helped them think more deliberately about their learning strategies and professional development in the lectures, laboratories, and traditional assessments. Participants consistently attributed perceived benefits to the clarity and intent of the questions rather than to the AI system itself. This preliminary finding aligns with the design intent of PathwayAI, which is to support metacognitively informed reflection rather than to function as an instructional intervention.

4.3 Engagement and Gamification Tensions

While visual progress indicators were generally viewed positively, some students expressed skepticism toward gamified elements when their connection to course outcomes was not immediately apparent. This feedback highlights the importance of transparency and alignment between gamification mechanics and educational purpose.

Additionally, attention was required to ensure that engagement metrics did not disadvantage students with irregular participation patterns due to external commitments.

From an instructional perspective, PathwayAI provided visibility into learning patterns that were not apparent through traditional assessments alone. Aggregated reflection data offered potential insights into how students experienced course activities and where additional instructional support might be warranted.

5. Discussion: Implications for Scalable Assessment in Engineering Education

The PathwayAI pilot underscores the potential of reflective assessment when supported by appropriate engagement infrastructure. Frequent, low-stakes reflective activities can generate meaningful evidence of professional development when students are motivated to participate consistently.

This work suggests that AI systems may be most effective when employed to scaffold and scale theoretically grounded assessment designs rather than to act as autonomous pedagogical agents. By maintaining a clear separation between learning theory and technological infrastructure, PathwayAI preserves instructor agency while addressing practical constraints related to scale and workload.

Although limited in scope, the findings point toward a replicable assessment model that could be extended to other project-based and professional development–focused engineering courses for the next step.

6. Conclusion and Future Work

PathwayAI represents a design-oriented approach to addressing a longstanding assessment challenge in engineering education: making professional competencies and belonging visible, accessible, and meaningful at scale. By combining structured reflective practice with gamified engagement and AI-supported analytics, the system offers a dual-purpose tool that supports both student self-awareness and instructional insight.

Future work will focus on scaling implementation to full course cohorts, validating AI-generated analytics against human-coded data, and systematically examining relationships between reflective engagement, professional competency development, and sense of belonging. Through continued refinement and evaluation, PathwayAI has the potential to contribute to more human-centered, transparent, and scalable assessment practices in engineering education.

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Appendix A

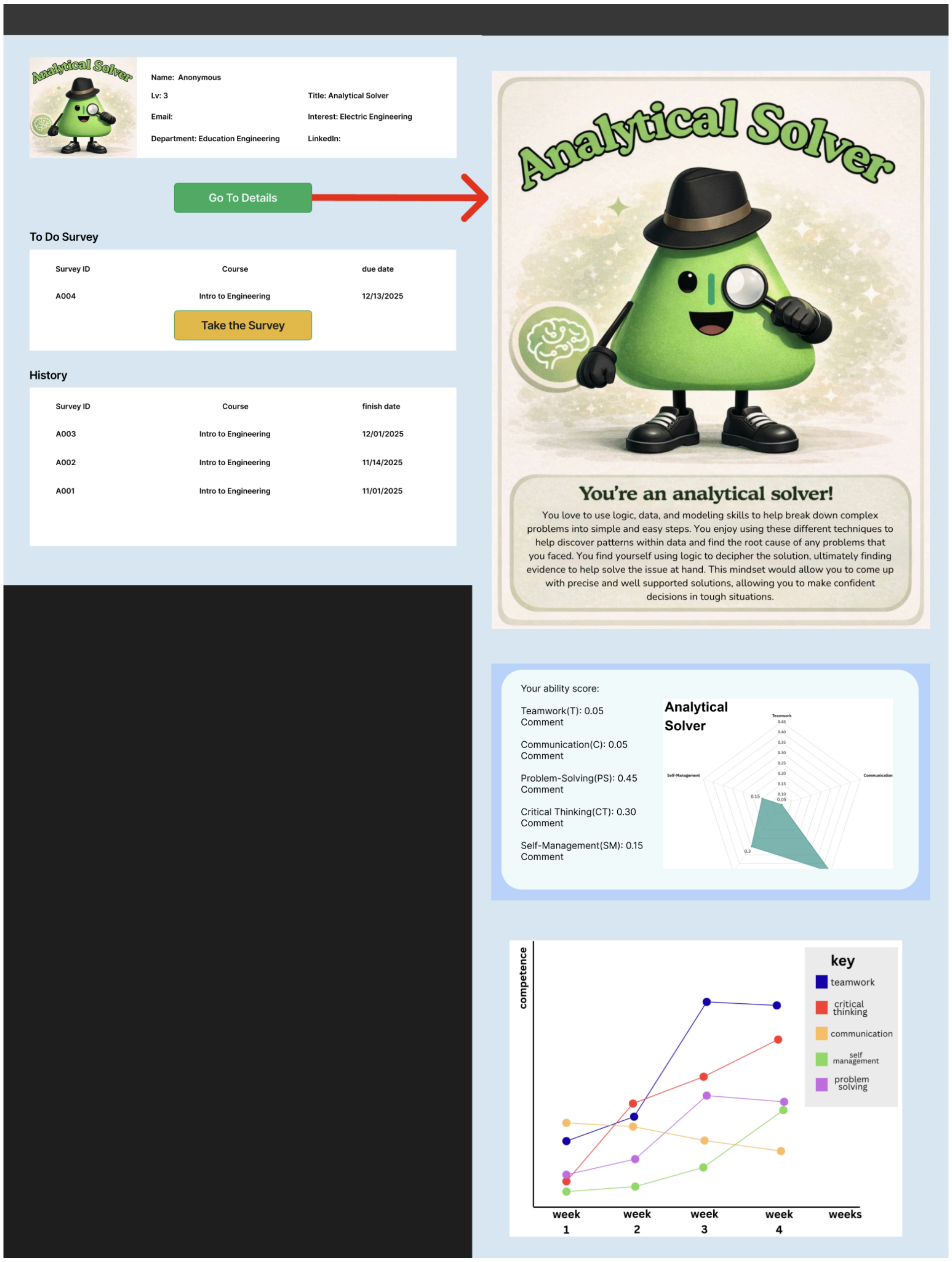

Fig. 2(c) Feedback interface with archetype and competency visualizations

Fig. 2(c) Feedback interface presenting an engineering character archetype, baseline competency radar chart, and longitudinal competency trends to support professional identity exploration.

Appendix B

PathwayAI Engineering Characters: Examples Derived from Student Surveys