

Future Calling: Generative AI-based System for Exploring and Prototyping Career Choices

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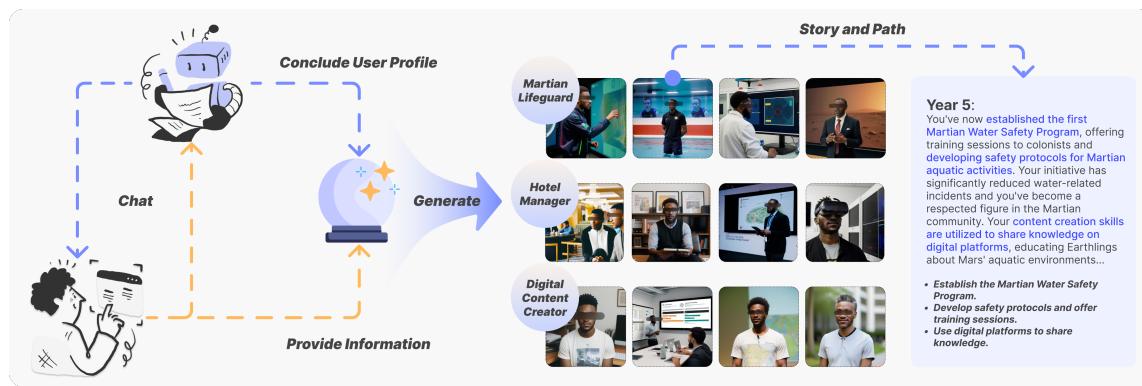


Fig. 1. Future Calling enables users to chat with the Career Advisor and get pages of future envisionment with images, stories, and career paths from the Future Envisioner. The career futures are customizable based on the user profile, which is continuously updated through interactions with the Career Advisor, and can be modified to align with the users' evolving needs and interests.

ABSTRACT

Choosing future career paths involves an exhaustive search over complex variables like motivation, financial considerations, and the possibility of failure. Current career planning tools are not adaptable to individual priorities and fail to provide users with concrete visualization of a long-term future career. We created Future Calling, a GenAI(Generative AI)-based application which provides a customized chatbot on career choice issues, and applies individual data to envision different potential future careers. We compared the use of Future Calling against text-to-image GenAI tool alone for career choice exploration in a between-group study. We found that Future Calling allowed participants to gain greater confidence and reflection than control. Participants used the application by repeatedly iterating, questioning, and conversing to compare their career futures, exploring detailed aspects and preferences of different career paths. This work highlights the way GenAI can support human decision-making by fostering imagination and reflection about potential futures.

CCS Concepts: • Human-centered computing → Collaborative and social computing.

Additional Key Words and Phrases: Career Planing, Generative AI

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53 1 INTRODUCTION

54
 55 For students and new graduates embarking on new career choices, an established career plan is critical to their success.
 56 These young people are in their emerging adulthood, typically aged 18 to 30, a crucial period for self-exploration,
 57 identity formation, and making significant career decisions as they transition from education to the workforce [? ?].
 58 They face the difficulty of navigating a myriad of variables, such as job desirability, financial rewards, and personal
 59 interest [1, 11, 19]. Additionally, they struggle to access comprehensive career information and receive guidance on
 60 potential career paths [21]. In this way, the final career choices often contradict the preferences and expectations of
 61 young people, contributing to university dropout rates and poor job performance [30, 54]. This highlights the need for
 62 a more tailored approach that caters to each individual's unique aspirations and circumstances [18, 50], promoting
 63 pro-active exploration of possible career paths.
 64

65 Traditional career planning tools such as personality assessments and skills inventories often provide young people
 66 with a brief career view based on past data. However, in today's era of rapid technological and social advancement,
 67 they fail to meet the individual developing needs for higher customized and diverse choices based on many factors like
 68 job expectations, development prospects, financial rewards, and personal interest [2, 45, 48]. Although some studies
 69 have leveraged emerging technologies such as machine learning to analyze personal information and generate suitable
 70 career plans and objectives for more personalized career exploration and decision-making support [23, 57, 61], and
 71 others have employed chatbots to provide career counseling, analysis, and guidance [36, 38], these approaches still fall
 72 short in offering users a fully customized career plan. More importantly, they often lack a visualized career trajectory
 73 that presents users with actionable choices and supports them in following their plans more effectively [60].
 74

75 The emergence of generative Artificial Intelligence (GenAI) technology offers a potential method. Applications like
 76 ChatGPT ¹ utilizing Large Language Models(LLMs) could show the potential for personalized guidance by generating
 77 tailored content, which has been used to power conversational agents to provide career counseling to students leading
 78 a reflection on their plans [16]. Besides, text-to-image models such as DALL-E 3 ² and Midjourney ³ demonstrate
 79 capabilities for visualizing personalized imagination of the futures. When combined with face-swap applications, which
 80 digitally alter a person's face with another, these models can create realistic, individualized images of users' future
 81 selves[29, 33, 47], providing the possibility for tangible visualization of long-term career prospects with realistic future
 82 self images. ⁴ and generates a specific envision of the future, which is transformed into content depicting stories of
 83 users' career journeys, and advice on the career paths with images generated by DALL-E 3 and Face-swap API ⁵. Aiming
 84 to enable presenting future career prototypes in fluent interaction with GenAI and exploring imaginative AI-generated
 85 content for users.
 86

87 In this study, we developed Future Calling, a GenAI-based system designed to support career exploration by
 88 simultaneously facilitating the discovery of potential career directions and visualizing corresponding career trajectories.
 89 By leveraging generative AI's capabilities in language understanding and visual generation, the system aims to address
 90 limitations in traditional career exploration, such as the lack of personalized guidance and difficulty envisioning
 91 long-term career outcomes. Informed by insights from formative workshops, the system integrates a GPT-4-powered
 92 Career Advisor⁶ to support conversational career guidance. It generates speculative future scenarios, represented
 93

94 ¹<https://chat.openai.com/>

95 ²<https://openai.com/index/dall-e-3/>

96 ³<https://www.midjourney.com/home>

97 ⁴<https://openai.com/index/gpt-4/>

98 ⁵<https://ai.baidu.com/tech/face>

99 ⁶<https://openai.com/index/gpt-4/>

105 through narrative descriptions of users' potential career journeys and illustrated with visuals created using DALL-E 3
106 and a face-swap API⁷. The system explores how generative AI can support the prototyping of imagined career futures
107 through interactive and personalized content.
108

109 The design and testing of the Future Calling addresses the following research questions:

110 **RQ1.** How do we enable young people to explore their career choices by leveraging GenAI to envision potential
111 futures?

112 **RQ2.** How do young people interact with Future Calling and how effective are these interactions for exploring career
113 choices?

115 To address the research question, we ran a within-group study to observe how users interact with this system. We
116 recruited 20 young people aged from 18 to 30. The user study highlights how participants interact with and get affected
117 by the system's ability to provide users with personal discussion and future content generation on the aspect of career
118 planning.
119

120 The main contributions of this paper are:

- 121 (1) The development of a GenAI-based system for AI-assisted career exploration, which leverages user-centered
122 design to visualize future career paths and enhance collaborative career planning for young users.
123 (2) A qualitative exploration showing how *Future Calling* helps users explore and refine their career options through
124 personalized visualizations and contextual storytelling, improving engagement and career self-efficacy.
125 (3) Providing design insights for career planning systems with AI-generated persona and specific recommendations
126 for extending GenAI integration to diverse contexts and audiences in career development applications.
127 (4) Demonstrating the integration of GenAI tools into social systems, showcasing their role in supporting personal
128 development through AI-enhanced career exploration.
129

132 2 RELATED WORK

134 2.1 Career Development Theory

135 Career development is a lifelong journey that begins in adolescence and ends in retirement [8]. Donald Super proposed
136 a theory of career development [55]. While traditional career guidance focuses on career choices and predictions of
137 career success at some point in the future, Super emphasized the need to understand and anticipate careers. He outlined
138 five main stages of career development [55], with adolescence being considered the most critical period for career choice
139 [27]. This is the period when individuals try to learn about themselves and find their place in the workplace, which
140 Super calls the exploratory stage of career development. Through classes, work experiences, and hobbies, adolescents
141 increase their self-awareness of career values, career interests, and career competencies, and figure out how they fit
142 into a variety of careers [1]. Super [56] states that exploratory behaviors are influenced by a person's perception of
143 planning and Exploratory behavior is influenced by one's perception of planning and exploring the future, and this
144 behavior includes "looking forward" and "looking around".
145

146 Career decision-making is considered complex and highly individual [21]. During the Exploratory Stage, when career
147 options are limited but not yet finalized, young people face challenges in clarifying, specifying, and implementing their
148 decisions. The main challenges they face include a lack of awareness of specific careers [1], inconsistent information
149 from external sources, confusion about personal preferences [14], and internal and external conflicts [21]. Additionally,
150 challenges in today's job market, such as the increasing number of career options and the need for more frequent job
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152 ⁷<https://ai.baidu.com/tech/face>

transitions [3], demand dynamic and personalized solutions. Gati et al. [20] introduced the "PIC Model" to help explain the career decision-making process, defining three core stages. In the *Prescreening stage*, individuals need to identify a set of promising alternatives that align with their interests. In the *In-depth exploration stage*, they further explore and refine their options, assessing the fit between career choices and personal capabilities and interests. Finally, in the *Choice stage*, they must select one of the alternatives. Yet there remains a lack of effective tools that support young people in envisioning and navigating diverse career paths. To address this gap, we aim to build a system that helps users explore alternative career choices and make more informed decisions.

2.2 Traditional Career Planning Tools

Individuals often use career planning tools to help them make career choices. Research has shown that using the right tools for career planning can help individuals develop a positive mindset [49], which in turn will influence academic and career outcomes and improve performance and decision-making processes [4, 62]. Traditional career planning methods include scale assessments and skill inventories such as the Hollander Career Test, the Schein Career Anchor Assessment, the Career Student Planning Scale (CSPS). These methods typically focus on static assessment of personal traits and matching personal characteristics to careers to help individuals make career decisions. However, traditional career planning tools struggle to adapt to rapidly changing career prospects and the complex needs of individuals [2, 45, 48]. Magnusson [42] emphasized that simple approaches are insufficient to address the dynamic nature of career decision-making. The career counseling process needs a more nuanced understanding of self-concept, adaptability, and personal meaning construction [24, 53].

Recent career planning tools, including established software like CareerExplorer⁸, CareersPro [25] and Career Guidance Application (CGA) [26], offer personalized guidance that helps individuals make informed decisions about their careers by connecting to the Internet. These tools aim to provide targeted guidance that aligns users' interests, skills, and goals with potential career paths [14]. They can be better aligned with individual preferences and significantly increase user satisfaction compared to traditional methods [59]. However, due to their lack of adaptability and their inability to provide a tangible visualization of long-term career prospects, these tools are increasingly failing to meet users' individual needs. Moreover, they focus only on career and learning perspectives, ignoring how other parts of users' lives may affect their future professional and academic planning.

2.3 Leveraging GenAI for Career Planning

GenAI is seen as a potential tool for supporting career planning. Large language models like ChatGPT and Claude⁹ have powerful text processing and generation capabilities while image-generating tools such as DALL-E and Midjourney excel at quickly transforming text into visual content. These capabilities have the potential to enhance users' inspiration and imagination in career planning contexts.

Several studies have explored the use of GenAI in career counseling and reflection. For example, CareerSim [15] is a role-playing simulation that supports self-career assessment through reflective decision-making. Using GPT-4, it creates personalized career scenarios by combining real-world alumni data with AI-driven events. The system dynamically adapts to the user's natural language input, providing tailored experiences for career reflection. Their user study showed that CareerSim effectively fosters users' self-reflection and informed decision-making. Besides, Pataranutaporn et al. [47] leverages GPT-3.5 and StyleCLIP to simulate personalized conversations with a future self. Through a user study,

⁸<https://www.careerexplorer.com/>

⁹<https://claude.ai/>

they demonstrated that such AI-powered conversations can improve individuals' connection with their future selves, facilitating deeper reflection on career aspirations and personal development. Moreover, GenAI has also been used in career planning areas like vocational education [17], university students' career guidance [31] and career development in specific areas [31]. However, there's still a gap in deeply utilizing GenAI for career exploration, and almost no visualization approach has been adopted yet.

3 DESIGNING FUTURE CALLING

To develop a system that allows users to explore a variety of career futures with visually immersive experiences, while adapting to their needs and preferences, we first conducted formative workshops to investigate how individuals visualize their future selves using Generative AI (GenAI). The insights gathered from these workshops not only deepened our understanding of user perspectives but also informed the design of the system.

3.1 Formative Workshops

3.1.1 *Methodology and Procedure.* We recruited 19 participants aged 18–23 from a university setting, ensuring a diverse range of academic backgrounds and career aspirations. Each workshop session was conducted individually and lasted approximately 30 minutes, structured into three phases: (1) a technical introduction, (2) an image generation task, and (3) a reflective interview. The workshops including the following user study passed the university's ethics review, and the data collected was analyzed while maintaining the anonymity of the subjects' identities.

- **Technical Introduction:** The session began with a 10-minute demonstration of Stable Diffusion WebUI integrated with FaceswapLab, a tool for generating images that incorporate participants' faces. Researchers explained the basic functionalities and provided examples to familiarize participants with the process.
- **Image Generation Task:** Participants were asked to generate images of themselves in three distinct scenarios: their appearance, lifestyle, and career in the near future (1 year) and the distant future (20 years). Participants worked independently, with researchers available to provide assistance as needed. They were encouraged to use the think-aloud method to verbalize their thoughts and decision-making processes, which were recorded by researchers through audio documentation with consent and detailed note-taking.
- **Reflective Interview:** After completing the image generation tasks, we conducted open-ended interviews to explore participants' experiences, challenges, and perceptions of the generated images. These interviews were audio-recorded with consent, transcribed, and analyzed using inductive thematic analysis.

3.1.2 *Data Analysis.* Three researchers independently coded the transcribed data to identify recurring themes and patterns. The coding process followed an inductive approach, allowing themes to emerge organically from the data. After initial coding, the researchers collaboratively discussed and refined the themes to ensure consistency and minimize bias. This iterative process resulted in a robust set of insights that informed the design of our system.

3.1.3 *Key Challenges and Insights from the formative workshops.* As shown in Fig.2, our analysis revealed three primary themes that highlight the challenges and opportunities of using GenAI for future visualization:

- (1) **Challenge 1: Difficulty Envisioning and Describing Future Selves:** Participants consistently struggled to imagine and articulate their future selves, particularly in terms of career aspirations. Many expressed uncertainty about their long-term goals and found it challenging to craft detailed prompts for image generation. For example, one participant remarked, "I don't even know what I want to do next year, let alone in 20 years." This insight

underscores the need for guided assistance in career exploration and visualization support to help users bridge the gap between abstract aspirations and concrete representations.

- (2) **Challenge 2: Lack of Narrative Depth:** Participants frequently described the generated images as "lacking a story" or "feeling impersonal." For instance, one participant compared the images to "subway ads with no purpose or connection to me." This feedback highlights the importance of integrating narrative elements into visualizations to create a more immersive and meaningful experience. Without a narrative context, the images failed to resonate with participants on a deeper level.
- (3) **Insights: Positive and Creative Experiences with GenAI:** Despite the challenges, participants reported positive outcomes from engaging with GenAI. Many noted reduced anxiety and increased confidence after seeing visual representations of their future selves. For example, one participant shared, "Seeing myself in 20 years made me less nervous about getting old." Additionally, some participants explored unconventional and creative career paths, such as becoming superheroes or national leaders, demonstrating the playful and exploratory potential of GenAI. These findings suggest that GenAI can serve as a tool for both practical career planning and imaginative self-exploration.

3.1.4 Implications for Design. The insights from the formative workshops informed the design of Future Calling, our GenAI-based application. Specifically, we incorporated features such as guided prompt generation(Challenges 1), narrative-driven visualizations(Challenges 2), and interactive chatbot support to address the challenges identified by participants. By combining these elements, we aimed to create a system that not only adapts to individual needs but also fosters deeper reflection and engagement with future career possibilities.



Fig. 2. Participants from the formative workshops encountered the following difficulties: envisioning their future selves and storytelling through GenAI images. But the future images helped them reduce anxiety through positivity and explore imaginative creations.

313 3.2 Design Consideration

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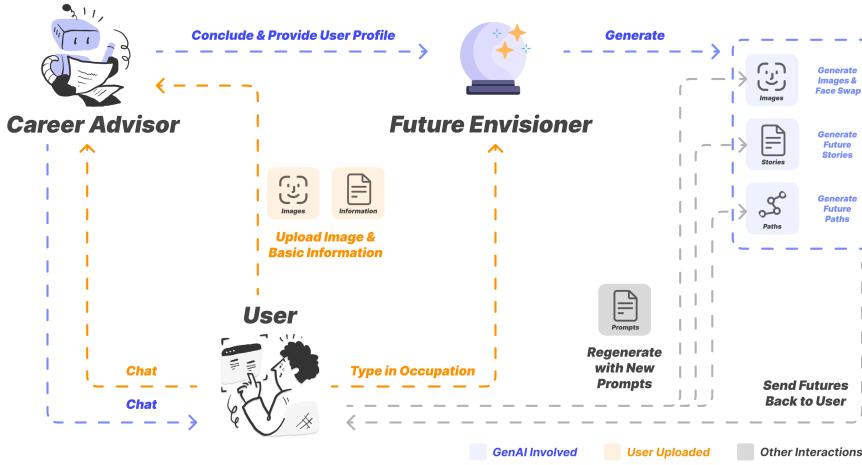


Fig. 3. System Design: The system consists of two main modules: a conversational AI module as a Career Advisor, a Text-to-Image AI module as a Future Envisioner.

After gaining the above insights from the formative workshops, we developed our design considerations, illustrating the user experience flow and system implementation through user scenarios. To create a seamless, user-friendly experience that offers personalized visualizations of users' career futures. Personalization is achieved through the system's capacity to continuously explore and adapt to users' evolving interests, forming a dynamic user profile and updating career suggestions as users engage with the application.

In career planning, human mentors always play a crucial role as career advisors to provide socio-emotional, instrumental, and informational support [35, 52]. LLMs, which can generate creative content and narratives tailored to user input, form the core of our design approach [37, 41, 46], playing as a career advisor during the interaction. LLMs such as ChatGPT, are particularly effective in maintaining long-context and human-like conversations, which are essential for engaging users in meaningful reflections. Thus, our design included an LLM-powered chatbot as a career advisor to enhance the user experience and form user profiles during the interaction. By leveraging LLMs, users no longer need to actively imagine and manually input descriptive text prompts for AI-generated imagery models, instead, they are allowed to focus more entirely on their career exploration. This addresses Challenge 1 identified in the workshop—participants' difficulties in crafting visual descriptions.

When it comes to the design of presenting the career futures in our system, we aimed to create an immersive process for visualizing career futures by combining narrative elements with rich visual cues. As Challenges 2, Career-related narratives help individuals make sense of their vocational experiences and plans, integrating both subjective and objective aspects [10]. We aimed to present continuous career stories spanning 1 to 20 years based on users' preferences. The consideration of this time frame is to align with the concept of connecting with one's distant future self [22, 51]. To make the narratives more practical, we also included career paths, or actionable advice to help users reflect on how they might achieve their envisioned futures.

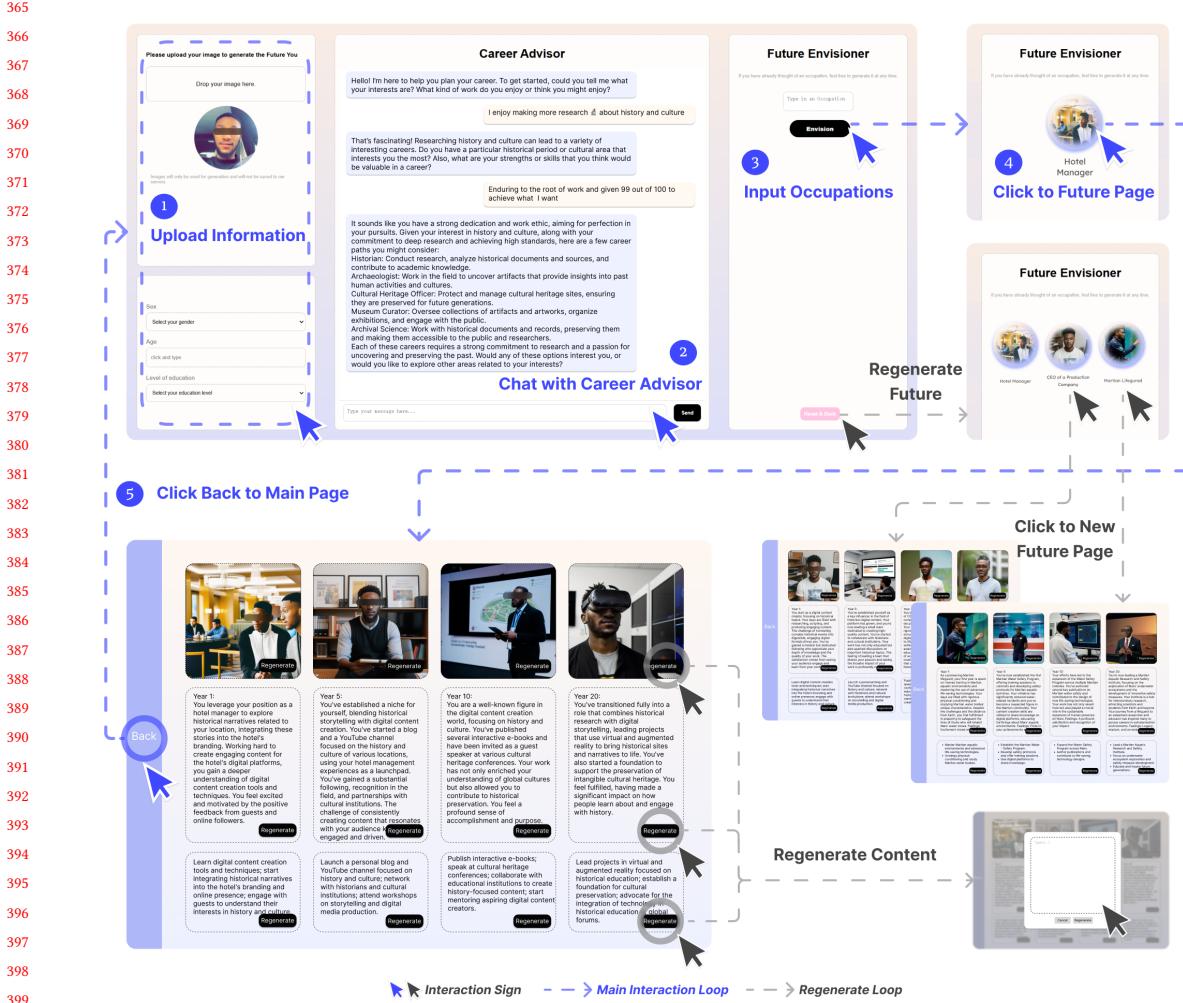


Fig. 4. Illustrative User Scenario in Future Calling: Anthony's Interaction Flow from Career Advisor to Future Visualization

For the visualization of the career futures, we chose generative AI like DALL-E, which can produce innovative, composite images to simulate the futures. These technologies combined with face-swap AI applications enable age-processed visuals that incorporate users' appearances, making it possible to generate future self-images that foster time-oriented behaviors, such as saving for the future, academic delay of gratification, and career maturity [9, 28, 29].

Research suggests that LLMs often perform better in independent tasks when designed as multi-agent systems [58]. Therefore, we adopted a multi-agent approach, designing two distinct modules: the Career Advisor and the Future Envisioner. In Fig 3, We presented a metaphor of the user flow on using Future Calling with Career Advisor and Future Envisioner. The prompt design of the LLMs is detailed in the Appendix.

417 3.3 User Scenario

418 In this section, we provide an illustrative example of how users interact with Future Calling as Fig 4 Anthony, a junior
419 in college, is grappling with uncertainty about the future. To gain clarity, Anthony launched the application “Future
420 Calling” and proceeded to upload personal details, including a photograph and demographic information, as guided by
421 the prompts and tutorials within the platform. Engaging in a dialogue with the AI Career Advisor embedded in the
422 interface, Anthony receives emotional support and guidance. Anthony shares a wealth of personal interests, hobbies,
423 and competencies, which the AI Career Advisor uses to offer insightful advice and to suggest potential career paths.
424 The mentor also prompts Anthony to utilize the “Future Envisioner” on the right side of the screen, inviting the input
425 of desired professions to visualize corresponding future narratives.
426

427 Procedure: After entering the desired profession, Anthony waits for the generation of future content, which takes
428 approximately one minute. Upon accessing the “Future Content” page, Anthony is presented with a quartet of vi-
429 sualizations and narratives depicting life in one, five, ten, and twenty years. Accompanying these visualizations are
430 tailored “Career Path” recommendations outlining the steps required to achieve each phase. When desiring alternative
431 perspectives, Anthony provides feedback to modify the images and re-generates the content. Similarly, if dissatisfied
432 with a particular narrative, Anthony offers input to explore alternative futures. For more in-depth career guidance,
433 Anthony submits specific requests and triggers a re-generation by clicking the corresponding button.
434

435 After an immersive session of exploring and refining future possibilities, Anthony navigates back to the initial page
436 to experiment with different professions, thereby investigating a wider array of career prospects.
437

440 3.4 Implementation

441 In our design, we first guide users through career reflection using an LLM-driven career advisor, then combine GPT
442 with DALL-E to generate a visualized career path, integrating career counseling with career planning, encouraging
443 them to reflect on their career paths while simultaneously providing them with a visualized future career landscape for
444 reference.
445

446 The user interface of Future Calling is a web application implemented via React and JavaScript. The backend of the
447 system consisted of GPT-4, DALL-E 3 and Baidu FaceSwap API. Information inputted by users is structurally stored and
448 posted to the API, which returns the text of the conversation module and envisions module and the processed images.
449 The system design is shown in Fig.3.
450

451 *3.4.1 Career Advisor as Conversation Module.* Our design employs a GPT-4-based chatbot as the Career Advisor, which
452 engages users in ongoing conversations while providing career-related information. Through prompt engineering, the
453 Career Advisor is guided to gradually elicit personal information from users while maintaining a gentle, encouraging,
454 and professional tone to deliver tailored career planning advice.
455

456 After users input personal details, the system compiles this information into a user profile. The system prompt,
457 along with the user profile, is then submitted to GPT-4 to generate responses for each interaction. Throughout the
458 conversation, the Career Advisor frequently suggests various occupations to inspire career exploration within the
459 envisioning module. When users express interest in a specific career and click the corresponding button, the system
460 updates the user profile by extracting and organizing relevant information from the conversation history, such as
461 disclosed interests and experiences, to better refine the profile.
462

463 Advisor maintains a user-centric dialogue but also provides a concise user profile for Future Envisioner to generate
464 future career content.
465

469 **3.4.2 Future Envisioner as Envision Module.** In the envision module, we present users with a combination of text and
470 images to visualize their future career content. When users enter an occupation and click the Envision button, the
471 system utilizes the continually updated user profiles from interactions with the Career Advisor, along with the inputted
472 occupations, to generate three types of textual content stored in JSON format: a future story, a career path, and a future
473 image.
474

475 These three elements are prompted to be interrelated and cover four time stages: 1, 5, 10, and 20 years. Each stage
476 maintains continuity over time. For example, in Year 1:
477

478 "FutureStory1": "Year 1: You start as a digital content creator, focusing on historical topics. Your days
479 are filled with researching, scripting, and producing engaging content...",
480
481 "CareerPath1": "Learn digital content creation tools and techniques; start ", "FutureImage1": "Male,
482 26 years old, in a home office, surrounded by books and dual monitors displaying historical archives
483 and video editing software.....".
484
485 (Similar continuity applies for Years 5, 10, and 20.)

486 For the Future Images, the system posts the text as the prompts to the DALL-E 3 API to generate visuals, which
487 are then processed through the Baidu FaceSwap API to swap the face in the generated images with that in the user's
488 uploaded profile image, creating a realistic depiction of their future selves.
489

490 Finally, the future stories and career paths for all four stages are displayed on the second page of the web interface,
491 with the option to return to the first page, allowing users to generate different potential futures.
492

493 **4 USER STUDY**

494 To explore user interaction and evaluate the influence of Future Calling, we conducted a within-group user study with
495 20 participants. Participants interacted with Future Calling to visualize their career futures.
496

497 This approach also helps better assess the value of the system's engagement features, such as the tailored advice
498 from Career Advisor and narrative-driven visualizations from Future Envisioner.
499

500 **4.1 Participants**

501 We recruited 20 participants (10 males, 10 females, aged 18-25) via recruitment posts at several universities in China. 10
502 of them are undergraduate students, 6 are graduate students, and 4 are in the early stages of their careers (working
503 less than or equal to 3 years). All participants were ethnically Chinese and English speakers, with 10 of them having
504 international education backgrounds. The study was conducted in Mandarin and online. For convenience, we refer to
505 the participants in the Future Calling Group as P1-20. For each participant, we provided an honorarium of 30 CNY. The
506 demographics table of the participants is attached in the Appendix.
507

508 **4.2 Procedure**

509 Participants first completed a pre-survey questionnaire as a baseline measurement. To avoid demand characteristics,
510 participants were given a one-week interval before being invited to participate in our study via Zoom or Tencent
511 Meetings. Then they were invited to interact with the Future Calling, which lasted around 30 minutes. All participants
512 were asked to think out loud during the process and were frequently asked questions about their feelings, perceptions,
513 and thought processes on the spot. Finally, we asked participants to complete a follow-up survey, which was similar to
514 the pre-survey. We also conducted a semi-structured interview with the participants to discuss their experiences and
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521 insights. The questions from the semi-structured interview can be found in the Appendix. The entire process lasted
522 about an hour and was recorded and transcribed for further analysis. All user data utilized and the content generated
523 by GenAI have been obtained with the consent of the participants for use in this research.
524

525 4.3 Measurement

526 We administered pre-surveys and post-surveys to assess participants' self-reported attitudes and perceptions toward
527 career planning and future thinking. A series of scales were selected to fit the context of this study.
528

529 To evaluate career planning, we focused on constructs such as career maturity and career self-efficacy. Career
530 self-efficacy pertains to an individual's beliefs or expectations about the capacity to succeed in career-related tasks
531 [32]. Career maturity is the degree to which individuals are prepared to make good vocational decisions [44]. These
532 are essential for understanding an individual's readiness and confidence in making career-related decisions [7, 9, 40].
533 We adopted the Career Maturity Inventory [13, 39] and the Career Self-Efficacy Scale [6] for our survey. Besides, to
534 mitigate experimenter effects, the survey questionnaire included five unrelated questions.
535

536 4.4 Data Analysis

537 The qualitative data analyzed consisted of screen recordings of experimental procedures, interviews, and transcripts of
538 think-aloud processes. The researcher first open-coded the transcripts [12] while playing the screen recordings as a
539 reference. Emergent codes were extracted and recorded including the interactive behaviors performed by the user and
540 the content of the interaction. A second round of coding was then conducted to categorize the initial codes into themes
541 about the nature of the interaction and the resulting experience. Two researchers independently categorized and coded
542 the data to minimize bias before engaging in detailed discussions as a group to compare and aggregate themes. All
543 data, codes, and themes were later translated into English for reporting. Quantitative data from the pre-survey and
544 post-survey were analyzed using inferential statistical methods to compare the effects on participants within the group.
545 Specifically, if the data met the assumptions of normality and homogeneity of variance, we used paired samples t-tests
546 to compare pre- and post-survey scores on career maturity and career self-efficacy within the group, providing further
547 insights into the observed results. Overall, these analyses were conducted to comprehensively answer RQ2: "How do
548 young people interact with and get affected by a GenAI-based system for exploring career choices?"
549

550 5 RESULT

551 In this section, we first present two participant cases that illustrate the actual user flow of Future Calling. Following
552 that, we provide the survey data analysis and the thematic results from the qualitative coding analysis.
553

554 5.1 Use Cases

555 5.1.1 *Case 1: Future Calling Helps P8 Explore and Compare Different Career Futures.* As shown in Fig.5, the case of P8
556 demonstrated how participants generate different career futures with Future Calling. P8 began by exploring various
557 career aspirations that were not closely related to her current field of study. P8 began by engaging in a conversation
558 with the Career Advisor, where she shared her interests and concerns, specifically her interest in design despite not
559 being in a design-related major. The Career Advisor suggested several career paths and continued to seek P8's input. In
560 response, P8 chose "illustrator" as a potential career and used the Future Envisioner to generate future scenarios for
561 that role. Throughout her interaction, P8 consistently used the same career input in both modules, allowing her to
562 compare different presentation formats of the career futures.
563

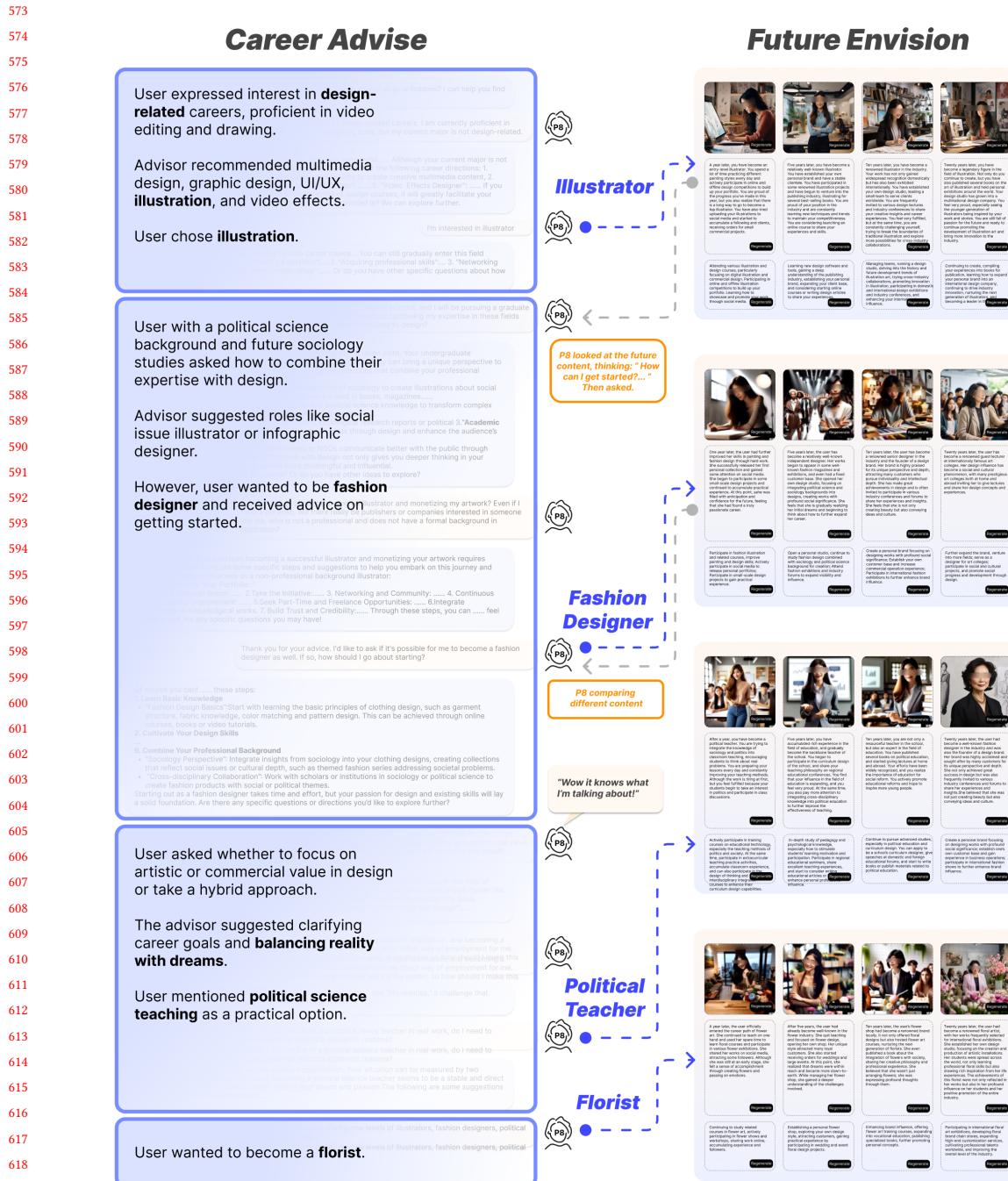


Fig. 5. User Flow of P8: An Example of Career Exploration and Comparison Using Future Calling. The participant explores diverse career futures, starting with a conversation with a Career Advisor. As the conversation deepened, P8 generated four different career paths. Through interactions, the participant compares various careers and seeks advice on integrating realistic expectations, potential dissatisfaction, and income differences.

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Fig. 6. Back and forth exploration and inquiry. P8 was surprised to explore different career futures and gained more reflection and questions with the Career Advisor.

P8 then added her background information, including her undergraduate and intended graduate studies, and inquired about how to integrate her academic background with a design-oriented career. After reviewing the illustrator future generated by the Future Envisioner, P8 asked about the detailed steps for entering the field.

Further, P8 and the Career Advisor discussed how to balance realistic expectations with ideal aspirations. P8 also sought advice on dealing with potential dissatisfaction in a job outside her interest, asking, "If I don't like the job of a political science teacher in real work, do I need to compromise for practical economic reasons?"

Finally, P8 conducted a horizontal comparison of different envisioned careers and inquired with the advisor about their income disparities. Throughout this process, Future Calling not only provided integrated career advice but also enabled comprehensive exploration and comparison of various career futures.

The case illustrates the user flow of P8, who was surprised by the ability of Future Calling to explore multiple different career futures through a process of back-and-forth exploration and inquiry. (See Fig.5 & Fig.6)

5.1.2 Case 2: P11 Refining Career Futures through Detailed Input and Iterative Regeneration. Another typical case to interact with Future Calling was P11, which refined the details of the career futures by enriching the input prompts with more personal information and preferences. As shown in Fig.7& Fig.8, P11, a sophomore engineering student, used Future Calling to explore suitable career paths to achieve his career goals. Similarly, P11 engaged in an initial conversation with the Career Advisor, during which he shared his basic information. Based on his input, the career guide asked more in-depth questions. For example, P11 said "I'm interested in Computer Science and Electronics", the Career Advisor asked more specific questions: "What specific areas are you most interested in? hardware, such as circuit design, or software, such as algorithms?" In this way, Career Advisor provided several potential career paths along with corresponding career advice, which helped P11 synthesize his information well.

P11 selected "Institute members of central enterprises" and generated a possible career plan. He then began reviewing and editing the generated Career Paths, adding further details and correcting inaccurate content. After completing a satisfactory and comprehensive career future, P11 generated another career future—"Tech entrepreneur and self-media blogger on technology." Similarly, he reviewed the career future and regenerated unsatisfactory sections. He requested "more details" to further enrich it and incorporated the networking advice he had previously received from the Career Advisor. Additionally, he regenerated the future career image in 10 years. Throughout the entire process, Future Calling

continuously adapted the generated content based on P11's feedback, ensuring that the career plan aligned with his personal information and career aspirations, facilitating the deep thinking of his career.

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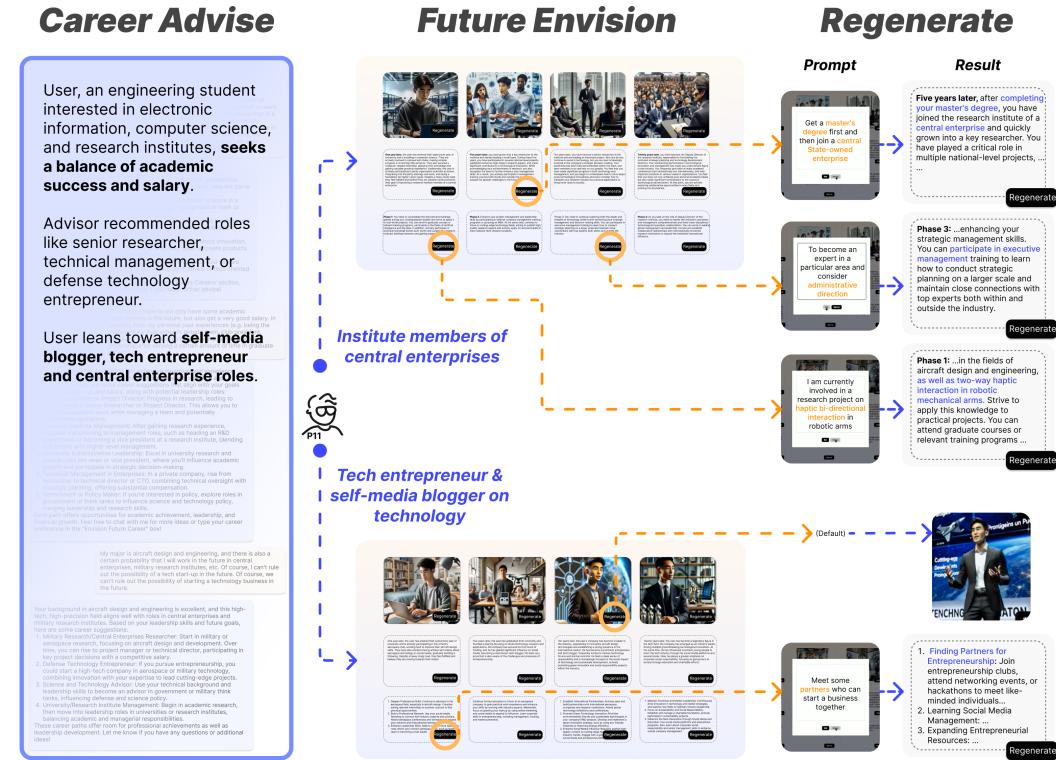


Fig. 7. User Flow of P11: An example of career plan generation using Future Calling, where the participant refines two career pathways ('Institute members of central enterprises' and 'Tech entrepreneur and self-media blogger on technology'). The process involves interactions with a career advisor, envisioning future scenarios, and editing prompts and career details through iterative regeneration.

5.2 Quantitative Result: Increased Career Self-Efficacy After Using Future Calling

Firstly, we assessed the reliability of the items within the variables, with the Career Maturity Score showing a Cronbach's alpha of 0.785 and the Career Self-Efficacy Score showing a Cronbach's alpha of 0.892. The results indicated that both variables had satisfactory reliability. Consequently, we averaged the items within each variable and performed a normality test on the data. The results showed that the data were all normally distributed. We conducted paired t-tests to compare participants' scores before and after using Future Calling. The results revealed a significant increase in career self-efficacy ($d=0.652$, $p = 0.009$). Additionally, there was a marginally significant improvement in career maturity ($d = 0.447$, $p = 0.06$), with mean scores higher after participants used Future Calling.

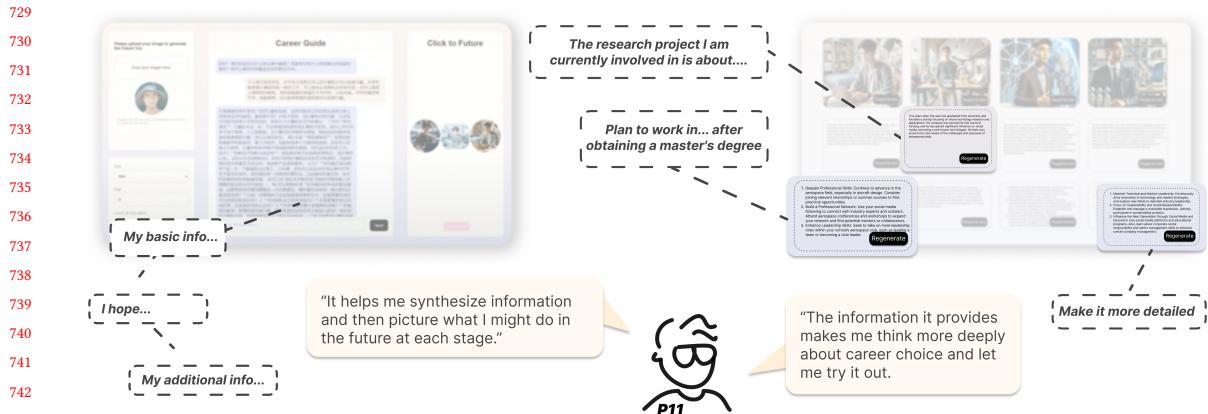


Fig. 8. P11 thought it good at information systemization, he kept updating his information and prompting his wills in both modules

5.3 Interaction with Future Calling Provokes Reflection

5.3.1 *Future Calling Helps Participants Collect, Organize and Combine Numerous Career Information.* Participants reported that the system was able to personalize conversations, generate detailed career plans, and allow participants to intuitively search for and customize their preferred careers. As shown in Fig.9, P1 asked some practical questions, then Career Advisor distilled and integrated the information he needed. P1 compared Future Calling to an internet search engine: *"For example, if I need to find some information about a specific career, it is much faster to ask it, and it gives me more information. If I use a search engine, I still need to sift through the information. For instance, the content I want might be buried in a very long article, and it still takes time to read the whole thing. Future Calling gives me a direct summary result."* This sentiment was echoed by P2, who emphasized Future Calling's ability to *"synthesize the information and thus help me make some career choices."*

Additionally, several participants mentioned that Future Calling helped them expand their horizons and explore career paths they hadn't previously considered. For instance, the Career Advisor recommended P7 to become a business consultant based on her major and identity, P7 said *"I knew about this career before, but I never thought I could apply it to my field. So I think it gave me a bit of inspiration."* Similarly, P11 highlighted that Future Calling provided novel career advice: *"The fact that it included internships in its portrayal of career paths made me realize that I could have pursued a tech position at a central company during my undergraduate years. The information it provided gave me an additional idea to explore."*

However, some participants had a negative perception of the information provided by the AI. For example, P5 remarked, *"The information was all searchable on the internet and of little value."* Other participants pointed out that the system's information lacked specific detail. As P9 noted, *"I need detailed information, such as telling me the exact date of the exam."* They expected Future Calling to offer more specific information rather than assist with general career decision-making.

5.3.2 *By Iterative Modifications, Future Calling Enables Participants to Focus on Specific Details of Their Future Careers and Fosters their Self-Reflection.* During the study, The iterative process of modification enabled them to focus on specific details of their future careers and fostered self-reflection, leading to more refined and thoughtful career plans.

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784 To become a software developer, you need to learn common programming languages like Python, Java, C++, or
785 JavaScript, and understand SQL for managing databases. It's important to use Git or GitHub for version control so
you can manage code and work with teams effectively. You also need strong problem-solving skills, including
786 understanding data structures like arrays and trees, as well as basic algorithms like sorting and searching. For web
development, you should know front-end technologies like HTML, CSS, and JavaScript frameworks such as React,
787 and back-end tools like Node.js or Django. Familiarity with project management methods like Agile or Scrum is useful
for managing tasks and working in teams. Additionally, you should know how to test and debug code and work with
APIs such as RESTful or GraphQL to integrate software features.
788
789 I want to be a software developer, what are the specific skills required?
790
791 Here are some recommended platforms and courses:
792 1. Online Courses:
793 • Coursera: Offers Python courses from top universities, like "Python for Everybody" by the University of Michigan.
• Udemy: Provides beginner to advanced Python courses. Look for courses like "Complete Python Bootcamp."
• edX: Check out Python courses from institutions like MIT, covering basics and advanced topics.
794 2. Interactive Coding Platforms:
795 • Codecademy: Great for beginners with interactive exercises and projects.
• freeCodeCamp: Offers a free Python curriculum along with real-world projects.
• LeetCode and HackerRank: For practicing Python coding problems and improving your problem-solving skills.
796
797 I want to learn Python, please suggest me some learning resources.
798
799 If I need to find some
800 information about a specific
801 career, it is much faster to
802 ask Future Calling than a
803 search engine.
804
805 P1

Fig. 9. P1 asked practical questions, such as necessary skills for software developers and resources for learning Python, and Future Calling quickly collected and organized the information P1 needed.

801 For example, P6 actively revised the narrative that depicted them conducting daily lab experiments, noting, *"That's not*
802 *possible; it's not like me."* Then he modified what he wanted to do in the future. This highlights the capacity of the system
803 to encourage participants to align the generated scenarios more closely with their actual aspirations and realities.

804 Participants also used the system to incorporate realistic elements and potential challenges into their career stories.
805 P6 added risks and contingencies, *"What if I lose the job?"* This prompted them to think more critically about stability
806 and alternative strategies in their career paths. P2 modified the five-year career story by including their aspiration
807 to pursue a master's degree, aligning the generated story with their personal goal of gradually accumulating project
808 experience as an assistant researcher.

809 The detailed storytelling of Future Calling enabled participants to consider intricate aspects of their future, which
810 traditional career planning tools often overlook. P11 incorporated networking strategies to support entrepreneurial
811 ventures, while P10 adjusted their plans by integrating new technologies and aligning their career path with contempo-
812 rary policies like the Belt and Road Initiative. These modifications allowed participants to explore how specific external
813 factors and personal decisions could shape their careers over time.

814 As P3 observed, *"It's like I'm starting to understand myself, what I like and don't like, and the choices I'm going to make."*
815 This iterative process not only refined participants' career goals but also deepened their understanding of themselves
816 and their future aspirations.

821 5.4 Perception and Engagement towards Future Calling

822 5.4.1 *Future Envisioner Encouraged Participants to View Their Career Futures as Achievable.* Firstly, participants perceived
823 that Future Calling provided step-by-step career goals and matching career advice, which increased the achievability of
824 the career plan. As shown in fig.10, P2 wants to be an algorithm engineer, and in her generated career plan, the 10-year
825 career goal is 'to become a senior engineer in the field of machine learning and to lead a multinational team', and the
826 corresponding career advice is 'attend international academic conferences; participate in multinational collaborative
827 projects; expand your network; actively do some small company projects and act as a leader to gain project experience.'
828 P2 found such a structure very meaningful: *"If I only looked at the career goal, it would just be an imagination for me, but*

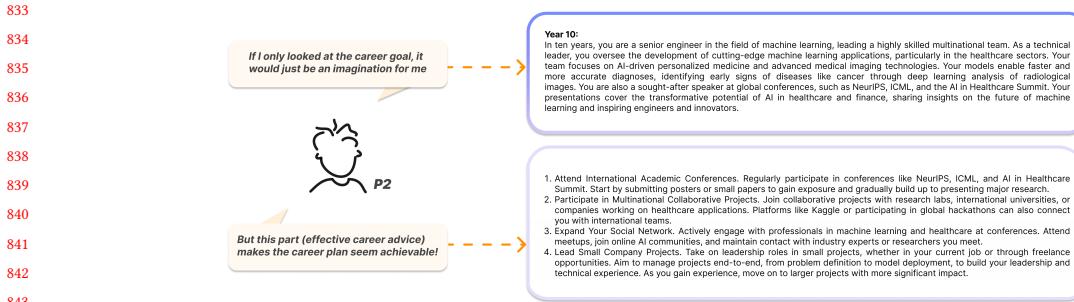


Fig. 10. P2 thought combining future stories with career advice makes career goals more achievable.



Fig. 11. Participants found that long-term and step-by-step career plans make career goals more achievable.

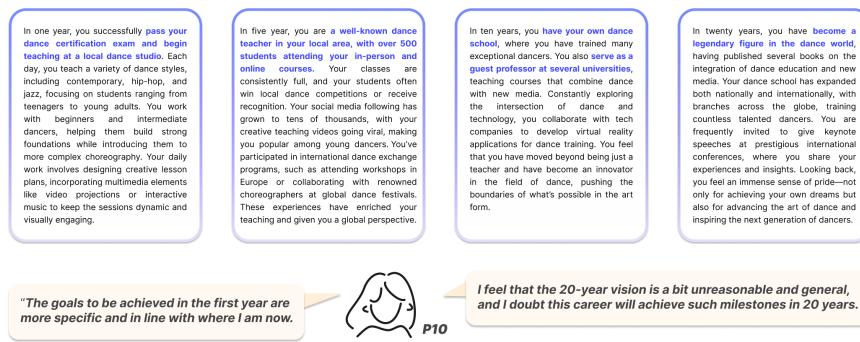


Fig. 12. P10 believed short-term planning was more specific while long-term planning was seen as unrealistic.

effective career advice makes it seem achievable!" This view was supported by P10, he found that Future Calling could provide career visions at different stages, which help him plan his career path step-by-step, as well as see how each step of effort reflects into the future. For example, in the 1-year career advice module, he was advised to 'look for internships in internet companies', which aligned with his five-year career goal of "working in a leading gaming company." P10 emphasized that this feature encouraged him to reflect more deeply on his future: *"Intuition may lead me to think more about it to some extent. Will I be like this in 5 years? 10 years? If I follow the current plan, will I be able to achieve this in 5 years? This may lead me to more in-depth thinking."*

Secondly, they reported that Future Calling provided them with a career plan for up to 20 years, which they might have overlooked when conducting their career planning. In Fig.11, P1 pointed out that "*AI can create a very long-term*

885 career plan and make the final goal seem less distant." P2 also recognized this, placing more emphasis on a continuously
 886 evolving career vision: "What I found most helpful was showing me career progress and what I had to learn at each step.
 887 When I was able to accomplish each stage, I felt that there was nothing impossible about this career plan." In this way,
 888 continuous and long-term career plans can be more persuasive to participants and help them build a clear vision for the
 889 future.
 890

891 However, some participants felt that short-term planning was more specific and credible while planning too far into
 892 the future (e.g., 20 years) was perceived as too general and unrealistic, leading to skepticism. For instance, P10's Future
 893 Story shows that he will become a dance teacher after one year; and he will open a dance school and become a dance
 894 professor after 20 years (See Fig.12. P10 stated, "The goals to be achieved in the first year are more specific and in line
 895 with where I am now. However, I feel that the 20-year vision is a bit unreasonable, and I doubt this career will achieve such
 896 milestones in 20 years." This discrepancy may stem from the fact that participants only input personal information
 897 relevant to their current stage, making short-term plans more aligned with their immediate concerns. A 20-year career
 898 plan is challenging to predict accurately due to the large time involved.
 899

900 5.4.2 *Contextual Storytelling Enhances Engagement and Realism in Career Visualizations.* Participants generated images
 901 indirectly through Future Envisioner, which provided contextual stories to accompany the images. Participants generally
 902 felt that the images complemented the narratives, adding depth and a personal connection to their career planning. For
 903 instance, P10 noted that the vivid imagery encouraged deeper reflection on their potential career paths, pondering
 904 whether they might achieve such milestones in 5, 10, or 15 years if they followed the suggested plans: "Intuition may
 905 make me think more about it to some extent. Will I be like this in 5 years? Will I be like this in 10 years? If I follow the
 906 current plan in 15 years, will I be able to achieve this achievement in 5 years? I may have some more in-depth thinking."(P10).
 907 While some participants (like P1) noted that the images occasionally reinforced stereotypes, such as the depiction
 908 of professionals exclusively in suits, the overall experience was enhanced by a sense of immersion and realism: "The
 909 photos posted are irrelevant. I don't think they look like me, and I think he has a stereotype of careers, that people in the
 910 workplace are all dressed in suits, which I don't think is good."(P3). P3 further emphasized that although the images might
 911 not be directly useful for career planning, they inspired a strong sense of confidence and the feeling of having already
 912 achieved their dreams. I think the pictures he generates are very interesting. He changed my face, as if I had realized my
 913 dream. He may not be very useful in career planning, but he can give people a strong sense of confidence. Additionally,
 914 some participants (like P6 and P8) found the images to be quite representative of themselves, though they also noted
 915 that the backgrounds and details often seemed repetitive or lacked variety.
 916

917 5.4.3 *People at Different Career Stages Tend to Have Different Needs in Career Counseling.* In our study, participants at
 918 different career stages had varying expectations for Future Calling, and took different behaviors to interact with the
 919 system. Participants without a clear career choice, such as those entering university or preparing to work, tend to ask
 920 the Career Advisor more general and exploratory questions. For example, P3, a first-year university student, asked:
 921 "How can I choose a career that suits me among so many options?" Similarly, P8, a fresh graduate, expressed her confusion:
 922 "Should I take on a job I don't like for practical reasons and societal pressure?" These participants were concerned with
 923 the alignment between their personal interests and career paths, and they hope to clarify their career direction through
 924 Future Calling.
 925

926 On the other hand, participants who already had a clearer career direction tended to ask Future Calling more specific
 927 and realistic questions, expecting it to serve as an assistant for retrieving detailed career information. For instance, P6,
 928 a PhD student in the food nutrition field, asked the Career Advisor to provide average salaries and career prospects for
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 930

different professions in his area. P9, a master's student in accounting, sought information on obtaining an accounting certification, asking specifically: "What are the requirements for taking the CPA qualifying exam? When and where is the exam held?"

Additionally, we found that participants in the career exploration stage were more proactive in generating multiple career plans and comparing the future visions of different careers. For example, both P3 and P8 generated four different career plans. P8 stated: "I love to use the Future Envisioner to search and generate different careers. In this way, I can compare how they develop." In contrast, participants with established career choices typically generated only one career plan. They showed little interest in exploring other careers. For example, P6 remarked: "I'm only interested in my current research field and want to know how I can develop in this area."

5.4.4 Perceived Overly Positive GenAI Content in Future Calling Fosters Confidence and Reflection, but Also Sparks Doubts. Although participants frequently reported that Future Envisioner was confidence-boosting and motivational, they also reported being overly positive.

For instance, P3 expressed, "It might be a little too positive, but it's not bad—it gives me confidence. When I think of this kind of life, I want to start studying right now! It's really good." This suggests that the positive scenarios helped participants envision a desirable future and fueled their motivation.

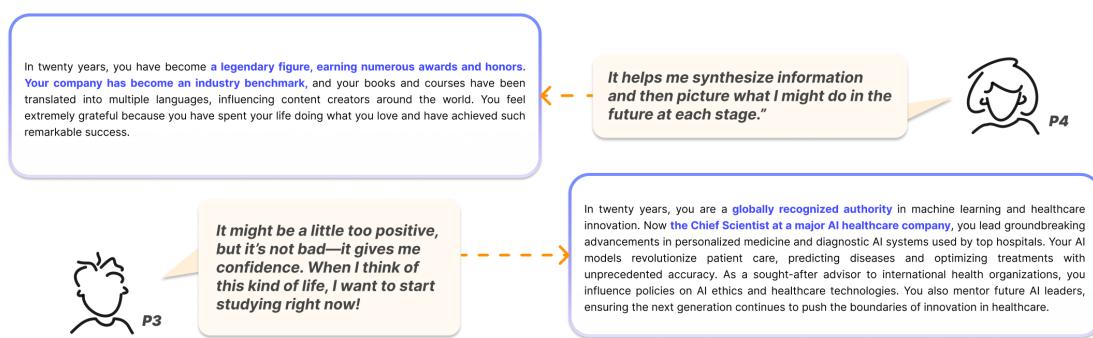


Fig. 13. Many participants showed skepticism about overly positive content (e.g. P4), while some believed that this could enhance motivation and increase confidence (e.g. P3).

However, many participants also expressed concerns about the overoptimistic nature of the generated content. P4 noted, "It's too successful. It sounds so simple, but every step can be unsuccessful, every step takes chance and luck." This highlights a recurring theme of doubt and anxiety, as participants questioned whether they could realistically achieve the idealized futures depicted by the AI. P10 echoed this sentiment, explaining that the overly positive future scenarios made them reflect deeply on whether they could truly reach those milestones in the coming years.

Some participants suggested the need for a more balanced approach, including the generation of less idealized or even negative future scenarios to provide a more realistic baseline. They felt that seeing potential setbacks could serve as a valuable heads-up, preparing them for the challenges ahead. P3 shared a desire for the AI to act like a mentor, cautioning participants about potential pitfalls and real-life obstacles, rather than presenting an exclusively rosy outlook: "I hope it can be like a senior telling you about the pitfalls and challenges you might face at different stages of your career."

Overall, while the positive GenAI content in Future Calling fostered confidence and reflection among participants, it also raised doubts about the attainability of such idealized futures.

989 6 DISCUSSION

990 6.1 GenAI Support Career Exploration: Summary and Interpretation of Results

991 These results indicated that participants believed Future Calling helped enhance their beliefs to succeed in career-related
992 tasks. This finding aligns with prior research. For example, Chishima & Wilson [9] found that exchanging letters with
993 one's future self boosted career planning confidence. This is because future self-continuity is a mediating factor in
994 strengthening career self-efficacy. Interacting with one's future self can bridge the psychological gap between the
995 present and future, fostering a stronger sense of self-continuity [?]. Enhanced future self-continuity positively impacts
996 academic and career planning, encouraging individuals to make career plans.
997

998 While career self-efficacy is crucial for career planning, career maturity is a broader construct that encompasses
999 decision-making skills, career knowledge, and long-term goal-setting [?]. Research suggests that although self-efficacy
1000 positively influences career planning, it may not be sufficient for fostering career maturity [?]. The lack of significant
1001 improvement in career maturity in Future Calling indicates that while the system effectively enhances career self-efficacy,
1002 it may not fully address the complexities of career decision-making that contribute to overall maturity.
1003

1004 This limitation arises because career maturity is shaped not only by self-efficacy but also by external factors such as
1005 socioeconomic background, career exposure, and parental support—many of which are beyond an individual's control.
1006 For example, Abdinoor [?] found that career maturity is significantly influenced by self-concept and parental support,
1007 suggesting that increasing self-efficacy alone is insufficient for achieving overall career maturity. Similarly, Duru [?]
1008 demonstrated that high career maturity often requires structured career education and real-world career experiences.
1009 These findings suggest that Future Calling may benefit from integrating external support systems, such as career
1010 mentorship, experiential learning, and career guidance in collaboration with parents, to foster comprehensive career
1011 development.
1012

1013 6.2 LLM-Powered Chatbot Advisor: Empowering Career Exploration Through Prototyping

1014 Traditionally, consulting a professional career advisor has been regarded as highly beneficial for college students to gain
1015 personalized guidance, explore career options, and make informed decisions about their professional paths [?]. In our
1016 study, we integrated an LLM-powered chatbot into Future Calling. The results indicated that it could potentially serve
1017 as a partial substitute for human career advisors when they are not accessible. Actually, existing studies have already
1018 introduced chatbots into career planning processes [45]. For instance, Suresh et al. developed a career counseling chatbot
1019 based on Facebook data [57]. Besides, D'Silva et al. built a chatbot by using psychological assessments and emotion
1020 detection for career recommendations [18]. Compared to traditional assessment tools like questionnaires and surveys,
1021 users generally reported that these tools were more convenient and time-efficient. However, due to technological
1022 limitations, previous chatbots could only respond to users' input linearly, offering limited responses tailored to users'
1023 personalities and needs [34, 57]. The emergence of large language models enables chatbots to process and respond to
1024 users' input in a more natural and human-like way. Like talking with a human advisor, participants in Future Calling
1025 could interact with the chatbot through open-ended conversations to explore their future career views, development
1026 paths, challenges, and potential concerns.
1027

1028 However, in this study, the chatbot's responses raised some concerns, as they were perceived to be too general.
1029 According to Super's Career Development Theory [55], adolescents in the Exploration stage often lack a complete
1030 career plan, seeking information to explore their interests and abilities. In such cases, conversations with LLM-powered
1031 chatbots are perceived as more useful, as these individuals have minimal career direction. However, for some participants
1032

already in the Establishment stage with clearer career goals, the chatbot's responses were seen as too superficial, lacking the depth needed to address their specific needs, such as skill enhancement and performance improvement. Building a database of successful job seekers' background information for specific roles, combined with a Retrieval-Augmented Generation (RAG) system to enhance LLMs, could be a potential solution for providing more tailored and contextually relevant career information to participants.

6.3 Envisioning a Visualized Future: Enhancing the Perceived Achievability of Career Plans

In Future Calling, we employed LLMs to analyze user interaction logs with the career advisor, facilitating the creation of detailed user profiles. This approach enabled the generation of a more personalized and comprehensive career path document for each user. This document included projected milestones for the first, fifth, tenth, and twentieth years, along with personalized recommendations on how to achieve these career stages. Besides, inspired by prior studies [?], by combining the Baidu FaceSwap API with DALL-E 3, we merged users' uploaded selfies with the future scenarios described in their career path documents, generating a visual representation of their "future self".

In the study, we found that presenting long-term, step-by-step career paths enhanced the perceived achievability of career plans and fostered greater user confidence. This could be related to Future Self-Continuity Theory [? ?]. Future self-continuity describes the extent to which individuals perceive their future selves as connected to their present selves, influencing long-term decision-making. When this connection is weak, people may prioritize immediate rewards over future benefits, leading to behaviors like under-saving or neglecting health. Conversely, a stronger sense of future self-continuity—where the future self is seen as similar, vivid, and positive—can encourage choices that support long-term well-being. With the support of generative AI, we generated personas from users' inputs and crafted future user scenarios, strengthening the connection between their present and future selves. Current career guidance systems often provide recommendations based on users' backgrounds but have been criticized for their lack of adaptability and long-term planning [36, 43], users frequently reported feeling unconnected, uncertain and lacking confidence in their ability to achieve the ambitious goals presented by such applications. There seem to be no connections between the current self and the future self. By describing each career phase and offering suggestions such as essential skills and career goals, LLMs were found to enhance participants' perceived achievability of their career plans, making future plans more possible. This effect may also be explained by the theory of career self-efficacy, which suggests that phased goal-setting can strengthen belief in career success [5, 32].

Additionally, the results suggest that presenting a visual representation of the future self in a career context may help users engage more concretely with potential career paths. In this study, Future Calling introduces DALL-E 3 and face-swapping technology to generate images of participants at different stages of their careers, paired with corresponding narrative descriptions of career scenarios. This approach enhances the vividness of career development. Participants found the generated images of their future selves to be engaging, which increased their immersion and helped them envision their future more concretely. As suggested by Hershfield's future self-continuity theory, the vividness of one's future self is crucial for enhancing self-continuity [28]. Visualizing the future self in career contexts could significantly strengthen individuals' sense of self-continuity, leading to a clearer connection between their present actions and long-term career goals.

Nevertheless, the generated future envisions were often criticized for being overly positive or excessively optimistic. For example, if a user mentioned wanting to work at a tech company, the generated outcomes often depicted them as highly prominent figures in 20 years, which reduced the perceived realism and believability of the results. This shows some biases in the model training process of generative AI. Self-Discrepancy Theory [?] posits that individuals

¹⁰⁹³ experience discomfort when there is a misalignment between their "actual self" (how they currently perceive themselves)
¹⁰⁹⁴ and their "ideal self" (who they aspire to be). Within this framework, the perception of overly positive results may arise
¹⁰⁹⁵ from a significant gap between the described "ideal self" and participants' current "actual self," contributing to a sense
¹⁰⁹⁶ of self-discrepancy. Fine-tuning LLMs and more strict prompt engineering could potentially address parts of this issue
¹⁰⁹⁷ by allowing the generated results to better align with users' current self-perceptions and career stages.
¹⁰⁹⁸

¹¹⁰⁰ **6.4 Ethical Considerations**

¹¹⁰¹ Powered by generative AI, Future Calling in this study was considered capable of supporting young people in exploring
¹¹⁰² and making career choices. However, we also acknowledged that there are some ethical concerns in this process
¹¹⁰³ correlated to the use of the technology.
¹¹⁰⁴

¹¹⁰⁵ First of all, personal data privacy is a significant concern worth noting. During the interaction with Future Calling,
¹¹⁰⁶ users may need to upload personal information such as academic background, financial status, and personal photos to
¹¹⁰⁷ create a more accurate user profile and receive more detailed advice and a more immersive experience. This practice
¹¹⁰⁸ could risk exposing personal data to the companies behind generative AI technologies. Using generative AI can
¹¹⁰⁹ sometimes be seen as an unfair trade-off, where users must share personal information to receive more personalized
¹¹¹⁰ responses. Prior studies have shown that despite privacy safeguards like PII detection and data anonymization, users
¹¹¹¹ often unintentionally disclose sensitive information when interacting with LLM-driven chatbots [?]. Therefore, before
¹¹¹² users interact with LLM-powered tools, they should be fully informed about potential privacy risks. Additionally,
¹¹¹³ training and using localized models to replace commercial ones could offer enhanced personal data protection by
¹¹¹⁴ minimizing external data exposure.
¹¹¹⁵

¹¹¹⁶ Another concern is that AI-generated futures may reflect biases in the training data [?], resulting in stereotypical and
¹¹¹⁷ homogenized outcomes that potentially constrain career exploration. While users may perceive their exploration as
¹¹¹⁸ open-ended, their choices might actually be shaped by underlying biases from training data of LLMs, limiting exposure
¹¹¹⁹ to unconventional or less represented career paths. To address this, future designs should reposition generative AI from
¹¹²⁰ a recommendation engine to a facilitator of independent thinking. Drawing on the idea of AI-framed Questioning [?]
¹¹²¹, AI systems should engage users through thoughtfully crafted prompts that encourage self-reflection and personal
¹¹²² goal alignment. Rather than declaring "This career fits you because..." the AI could ask, "What kind of impact do you
¹¹²³ hope to make through your work?" or "Which values matter most to you when imagining your future self?" These
¹¹²⁴ open-ended questions prompt users to reconsider their assumptions, clarify their aspirations, and actively construct
¹¹²⁵ their own career narratives. By guiding reflection instead of offering fixed answers, generative AI can better support
¹¹²⁶ exploratory and meaningful career decision-making.
¹¹²⁷

¹¹²⁸ **6.5 Limitation and Future Work**

¹¹²⁹ The AI models used in Future Calling exhibited limitations in understanding, representation, and bias. The LLM
¹¹³⁰ (GPT-4) often generated overly general and positive content, while the image model (DALL-E 3) frequently produced
¹¹³¹ visuals reflecting narrow professional stereotypes, which could reduce reliability and affect user trust and engagement.
¹¹³² Additionally, our user study had several constraints. Career self-efficacy and maturity were measured immediately after
¹¹³³ the experience, leaving the long-term effects of the system on young people unclear.
¹¹³⁴

¹¹³⁵ Our study focused exclusively on young adults (18-30), overlooking children and adolescents who may derive greater
¹¹³⁶ value from AI-powered career visualization. Younger populations, during critical stages of identity formation, could
¹¹³⁷ experience amplified impacts from immersive future simulations given their sensitivity to story-telling and visual
¹¹³⁸ ¹¹³⁹ ¹¹⁴⁰ ¹¹⁴¹ ¹¹⁴² ¹¹⁴³ ¹¹⁴⁴ Manuscript submitted to ACM

metaphors. However, the system's potential impacts on earlier developmental stages remain unexplored, particularly how their evolving career consciousness might interact with AI-generated narratives.

Future work should address these limitations by enhancing the depth and specificity of LLM-generated content, especially for niche career paths and situational guidance. Extending evaluations to broader age groups (such as pre-teens versus adults) and culturally diverse populations could strengthen the generalizability of our approach while revealing how developmental and environmental factors shape AI-mediated career imagination. Reducing biases and expanding content diversity, including more balanced scenarios with both ideal and realistic trajectories, could help users form a more comprehensive and practical understanding of their career options. In addition, integrating up-to-date and localized data, such as regional job market trends and industry-specific requirements, could improve the contextual relevance and actionable quality of career guidance. This approach could better align AI-generated suggestions with real-world challenges, making the support more practical and grounded in current realities.

7 CONCLUSION

This study introduces Future Calling, a GenAI-based career exploration application designed to help users envision their career futures by integrating personalized chatbots, storytelling, and visualizations using GPT-4 and DALL-E.

The results of our user study indicate that participants engaged iteratively and proactively with Future Calling, fostering deeper reflection on their future careers. These reflective processes encouraged participants to critically evaluate their long-term goals and aspirations.

Our study reveals the potential of GenAI in career counselling and planning, demonstrating how integrating GenAI tools into social systems can support personal development through AI-enhanced career exploration.

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A SURVEY QUESTIONNAIRE**A.1 Career Maturity**

1353 C1: I cannot understand how some people can be so certain about what they want to do.

1354 C2: I know very little about the requirements for jobs.

1355 C3: I can really not find any work that appeals to me.

1356 C4: Everyone seems to tell me something different; as a result I don't know what kind of work to choose.

1357 C5: There are so many things to consider when choosing an occupation that it is hard to make a decision.

A.2 Career Self Efficacy

1360 E1: How confident are you in choosing a career that suits your interests, even if it's not widely approved or in high demand?

1361 E2: How confident are you in finding and understanding job market information relevant to your chosen field?

1362 E3: How confident are you in your ability to overcome academic or professional setbacks?

1363 E4: How confident are you in planning and preparing for the necessary steps toward your career goals?

1364 E5: How confident are you in assessing your abilities and aligning them with your career aspirations?

A.3 Irrelevant Questions in Pre-Survey and Post-Survey

1367 I1: You are experienced with Generative AI technology.

1368 I2: When making decisions, I tend to rely more on intuition than analyze the facts.

1369 I3: I am able to manage my time to balance work and personal life.

1370 I4: I am doing well in the team.

1371 I5: Compared to others, when I learn something new, it takes a lot of practice to feel good about it.

B THE OUTLINE OF THE SEMI-STRUCTURE INTERVIEW**B.1 Basic Information and Current Situation**

1386 (1) What is your current field of study? How satisfied are you with your current study and professional situation?

1387 Why?

1388 (2) How do you usually set professional goals and plans? What is your experience with using career planning tools
1389 or methods (such as career counseling, manuals, software)?

1390 (3) Before the study, what were your views on the application of AI technology in career planning?

1391 (4) What aspects of career planning do you hope AI can help you with?

B.2 Thoughts on the System

1395 (5) Which features of the system are you most interested in? Which features are most helpful for your career
1396 planning?

1397 (6) During the process, how well do you think the AI understands your information? Are there any inaccuracies or
1398 insufficiencies?

1399 (7) Does the AI-generated career planning content (including career goals, images, specific suggestions, etc.) meet
1400 your expectations? Is the vision for the future reasonable and balanced?

- 1405 (8) Are there any unreasonable aspects in the system's design and operation? Which parts are well-designed or
 1406 need improvement?
 1407

1408 **B.3 Interations**
 1409

- 1410 (9) What are your behavioral patterns and preferences during the experience?
 1411

1412 **B.4 Impact of the System on Users**
 1413

- 1414 (10) After using the system, have your career goals or plans changed? What are the specific changes?
 1415 (11) Has the system increased your confidence in achieving your career goals?
 1416 (12) How has the system helped inspire you to imagine the future and recognize/modify your career plans?
 1417 (13) Compared to traditional career planning methods, what are the strengths and weaknesses of this system?
 1418 (14) How willing are you to develop your career according to this plan?
 1419 (15) What suggestions do you have for the functions and design of this system?
 1420 (16) In the future, would you be willing to continue using similar AI systems for career planning?
 1421

1422 **C PROMPT TEMPLATE**
 1423

1424 **C.1 Prompt Template of Career Advisor**
 1425

1426 Please act as a student career counselor, communicating with users in a friendly and cheerful tone. Use concise and
 1427 clear language, ask for as much information as possible, and finally offer some professions for the user to choose from.
 1428 Keep your responses brief. Additionally, on the right side of your career counselor dialog box, there is an "Envision
 1429 Future Career" input box. Whenever a user asks how to generate their future career, you can remind them to type in
 1430 the future career they'd like to see on the right side and click Envision. What you need to do is: 1.Ask about the user's
 1431 interests, abilities, and aspirations to better understand their needs. 2.Incorporate related personality and career tests,
 1432 methods, or theories to inquire and understand the user. 3.Provide a range of professions for the user to choose from.
 1433

1434 **C.2 Prompt Template of Future Envisioner**
 1435

1436 #Please generate "FutureStory", "FutureImage", "CareerPath" for the user based on the user's user information [personal-
 1437 Info] and the occupation they want to become [customOccupation]. Please output directly JSON format, do not answer
 1438 other content. Output requirements "FutureStory": [Future Career Story] Please write the story of the four stages in
 1439 English: one year after the user, five years after the user, ten years after the user, and twenty years after the user. Each
 1440 stage needs to include what the user is working hard for, what they have achieved, and what they have gained. What
 1441 did you do, what are your thoughts and other information. Stories can be written to be interesting; "FutureImage":
 1442 [Future Image] generates English 4-stage image language descriptions based on user information and [Future Career
 1443 Story], including appearance, race (Asian by default), environment, action description, etc. For example: "FutureImage1"
 1444 : "Male, 19 years old, asian, short hair, watching laotop", "FutureImage4": "Male, 39 years old, asian, short hair, suits,
 1445 lecturing at the university" ; "CareerPath": [Career Development Path] Please list in English the four-stage goals, the
 1446 actions you need to take and the content you need to learn, such as what courses and activities you need to participate
 1447 in, what knowledge you need to learn, etc. In addition, "FutureStory1", "FutureStory2", "FutureStory3", "FutureStory4"
 1448 represent the future career stories in one year, five years, ten years, and twenty years respectively. The same applies
 1449 to "FutureImage1" and "CareerPath1". #Output format (output in JSON format): "FutureStory1": "", "FutureStory2": "",
 1450

1457 "FutureStory3": "", "FutureStory4": "", "FutureImage1": "", "FutureImage2": "", "FutureImage3": "", "FutureImage4": "",
 1458 "CareerPath1": "", "CareerPath2": "", "CareerPath3": "", "CareerPath4": ""
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D CODEBOOK

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D.1 Codebook for Behavior Analysis

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Code	Symbol	Explanation	Example
Exploration	X	User browses or explores different parts of the interface.	The user clicks on different page tabs to view various options.
Information Input	I	User inputs basic personal information.	The user fills in their age and education background.
Conversation	C	User engages in a dialogue with the AI chatbot.	The user asks the chatbot, “How can I find a suitable career?”
Plan Generation	G	User inputs a career and clicks a button to generate a plan.	The user enters “software developer” and clicks the “Generate Plan” button.
Plan Reading	R	User reads the system-generated career plan.	The user reads the career development suggestions for the next three years.
Plan Editing	E	User edits or adjusts the generated career plan.	The user modifies the suggested career path in the plan.
Pause	P	User pauses or remains inactive for a noticeable time.	The user stays on the career plan page without any further actions.
Other	O	Other behaviors not covered by the above codes.	The user closes the page or performs an unusual action.

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D.2 Codebook for Content Coding

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Code	Symbol	Explanation	Example
Question Asking	CQ	The user asks the AI chatbot questions related to career advice.	The user asks, “What career suits me?”
Information Provision	CP	The user provides background information to the AI chatbot.	The user describes their skills and experience.
Information Feedback	CF	The user gives feedback or makes a choice based on the AI’s suggestion.	The user selects a recommended career path from the AI’s response.
Blank Modification	EB	The user regenerates the career plan without adding any new input.	The user clicks the regenerate button without giving any additional prompts.
Information Correction	EI	The user updates their personal information to revise previous input.	The user modifies their work experience before regenerating the plan.
Request for Specificity	ER	The user asks for more detailed or professional advice.	The user requests more specific career development steps from the AI.
Exploratory Generation	EG	The user asks the AI to generate a completely different career plan.	The user requests a completely new career scenario.

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D.3 Codebook for Interview Data

Code	Explanation	Example
Future Visualization	Users believe long-term career planning or narrative helps them better envision the future.	“It gave me a vision of one, five, and ten years ahead – made the future feel less distant.”
Confidence and Skepticism	The system boosts users’ confidence and motivation, but some worry the plans are overly idealistic or unrealistic.	“I feel really confident now, but it also seems a bit too perfect and hard to achieve.”
Support in Career Transition	The system is helpful for those in early or unclear career stages, but less so for users with already clear goals.	“It’s great for people like me who got into grad school but didn’t have a solid career plan.”
Information Understanding	AI understands vague or minimal input, and can refine, expand, and clarify career directions.	“I gave basic info and it provided suitable career options, aligned with my overall direction.”
Stereotypical Visuals	The system’s generated images are seen as lacking personalization and reflect career stereotypes.	“The image didn’t feel like me – just a generic business suit look with no real connection.”
Information Integration	The tool helps users consolidate scattered information into clearer, summarized results.	“It’s faster and more complete than searching online; saved me from organizing things myself.”
Lack of Specificity	Some users found the career plan too general, lacking actionable or detailed learning paths.	“It didn’t specify what I should learn – just general suggestions without real steps.”
Exploration of Unknown Careers	The system supports curiosity-driven exploration of unfamiliar or overlooked career paths.	“I explored other careers just out of curiosity, and it helped me break some biases.”
Desire for Negative Futures	Users expressed interest in seeing ‘bad’ outcomes to mentally prepare for potential risks.	“If I can see the worst-case future, I can prepare myself – it’s like mental insurance.”
Overly Grand Narrative	Some felt the system’s future stories were too positive or abstract, lacking personal nuance.	“It felt like my identity was consumed by a grand narrative – too impersonal.”