PATHWISE: Make Smarter Career Decisions with AI Guidance

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Abstract—PathWise is an AI-driven platform that helps students make informed decisions about higher education after finishing grade 12. The system combines academic interests, cognitive skills, and career goals to create data-based recommendations. It uses detailed psychometric tests to assess various cognitive areas, including arithmetic, logical reasoning, critical reasoning, and creative reasoning. This creates a unique intellectual profile for each student. This profile shows the skills and interests of the student, helping them choose the right educational path. Smart AI algorithms look at test responses to provide personalized course recommendations, ensuring that the student's strengths match the academic needs. If there are skills gaps, the platform suggests other programs or additional pathways that use the strengths of the student. PathWise offers clear recommendations, helpful feedback, and an easy-to-use interface, making it accessible to all students. The platform helps reduce mismatches in course choices and boosts confidence in decision-making, leading to better academic and career results.

Index Terms—AI in Education, Career Guidance, Psychometric Assessment, Decision Trees, Random Forests, Rule-Based Systems, Intellectual Capability Index, Personalized Learning,
Student Profiling, Academic Path Recommendation, Cognitive Skills Assessment, Educational Data Analytics, Explainable AI, Adaptive Career Counselling.

I. Introduction

Career decision making is a critical component of the educational path, particularly at the end of Grade 12, when students are required to select academic pathways that significantly determine future professional opportunities. Despite the importance of this stage, existing research indicates that many students experience uncertainty in aligning their aspirations with their actual cognitive and academic capabilities [1], [2]. Mismatches between chosen career paths and student abilities have been shown to result in academic stress, dissatisfaction, increased dropout risks, and subsequent redirection of study programs, contributing to both psychological and economic costs [3], [5].

Traditional career guidance methods rely mainly on subjective self-reports, generalized aptitude tests, or standardized counselling frameworks, which do not adequately account for the multidimensional aspects of student decision-making [4], [7]. Interests, aptitudes, reasoning skills, and personality traits are rarely assessed in an integrated manner, leading to recommendations that are overly generalized or misaligned with actual student potential [6], [8]. Furthermore, such approaches frequently adopt a uniform model that disregards inter-individual variability in learning patterns, motivation, and cognitive strengths.

Advancements in artificial intelligence (AI) and machine learning (ML) have facilitated the development of scalable frameworks for personalized career guidance. Algorithms such as Decision Trees and Random Forests have demonstrated effectiveness in analysing structured educational datasets, delivering interpretable predictions while capturing complex feature interactions [9]. In addition, rule-based systems, when combined with psychometric evaluations, provide transparent decision pathways, ensuring that generated recommendations are explainable and adaptable across diverse student groups [10]. These characteristics make such approaches particularly relevant in educational contexts, where fairness, interpretability, and accessibility are essential.

Psychometric testing has also been recognized as a validated approach for the systematic evaluation of cognitive and personality dimensions. Assessments that measure logical reasoning, numerical aptitude, verbal ability, and personality traits provide quantifiable indicators of intellectual capacity and motivational orientation [11]. Integrating psychometric outcomes with ML-based methods enables the construction of composite indices, such as the proposed Intellectual Capability Index (ICI), which captures strengths across multiple domains in an objective manner. By combining psychometric evaluations with predictive modelling techniques such as Decision Trees, Random Forests, and rule-based systems, career guidance frameworks can more effectively align student aptitudes and interests with suitable academic and career trajectories.

This integration constitutes the foundation of PathWise, a system that combines psychometric profiling with interpretable ML algorithms to generate personalized, evidence based course and career recommendations. The framework produces explainable outputs and includes alternative program suggestions in cases of misalignment, thereby addressing the limitations of traditional guidance methods that lack adaptability and personalization.

II. Literature Review

The integration of artificial intelligence (AI), machine learning (ML), and psychometric assessment has been widely investigated for improving career prediction and educational decision support.

A. Personality and aptitude based career prediction

Personality traits have been identified as significant predictors of career success and adaptability. Rezaiee Fard and Amiri applied an Adaptive Neuro-Fuzzy Inference System (ANFIS) to model the relationship between personality profiles and career outcomes in data science professionals, demonstrating the predictive capacity of hybrid intelligent systems for career guidance [1]. Hussein further established that personality dimensions can be reliably used to forecast career success, highlighting the value of combining personality measures with computational models for informed career counselling [3]. Mojsilovic et al. integrated Random Forest and ANFIS algorithms to evaluate the academic achievements of professional students, achieving high predictive accuracy while maintaining interpretability [5]

B. Fuzzy and rule-based decision systems

Fuzzy inference and rule-based approaches have been explored as mechanisms to manage the uncertainty inherent in educational decision-making. Proninaa and Piatykopb introduced a fuzzy model for educational career choice, illustrating how rule-based reasoning can process imprecise inputs such as student preferences and abilities to generate robust recommendations [2]. These approaches support transparent decision pathways and are particularly suitable for contexts where explainability and fairness are required.

C. Psychometric testing and aptitude evaluation

Psychometric assessments remain a validated method for quantifying cognitive ability, reasoning skills, and personality traits. The GLOCON Training and Research Centre demonstrated that structured psychometric testing effectively uncovers student aptitudes and improves confidence in career decision-making [4]. Such assessments provide measurable indicators of intellectual capacity, enabling the construction of composite metrics like the Intellectual Capability Index (ICI) for objective student profiling.

D. Interpretable machine learning for career guidance

Recent studies have employed supervised learning models to improve prediction accuracy while preserving interpretability. Betrand et al. developed a career guidance system utilizing

Decision Tree, Random Forest, and Na¨ıve Bayes algorithms, reporting strong performance in matching student profiles to career recommendations [9]. These models are advantageous for educational applications due to their capacity to handle heterogeneous datasets and produce human-readable decision rules. Complementary research has emphasized the mediating role of psychological constructs such as self-efficacy, peer support, and emotional intelligence in career adaptability and employability, indicating that career guidance systems benefit from integrating cognitive and psychological factors [6], [8].

III. Objectives of the System

The proposed system, PathWise, is designed to guide students during the crucial transition from school to higher education. By integrating psychometric assessments with AI-driven analysis, it tackles common challenges such as uncertainty, stress, and mismatches between student abilities and chosen courses. In doing so, the system delivers clear, personalized recommendations that help students make confident and well informed academic choices, while reducing the chances of dissatisfaction or poor alignment with their selected pathways.

A. Assist Grade 12 Students in Decision-Making

PathWise is designed to guide students through the crucial stage of moving from school to higher education. It provides a structured, evidence-based approach that reduces the uncertainty many students face when selecting courses, helping them make choices with greater clarity and confidence.

B. Psychometric-Based Student Profiling

The system builds a detailed profile of each student using psychometric assessments that measure areas such as logical reasoning, numerical ability, critical thinking, and creativity. These insights highlight both strengths and areas for growth, giving a holistic picture of a student's academic potential.

C. Personalized Course Recommendations

Using AI-driven analysis of psychometric results, PathWise generates course recommendations tailored to each student. This ensures that suggested academic pathways are aligned with the individual's skills, intellectual abilities, and subject interests, minimizing the risk of poor program fit.

D. Alternative Pathway Suggestions

When a student's preferred course does not fully match their strengths, the system suggests alternative programs. These alternatives are selected to remain consistent with the student's intellectual profile and interests, keeping their career path aligned even if adjustments are needed.

E. Accessible and Inclusive Guidance

PathWise is designed to be inclusive and easy to use, ensuring that students from varied social, economic, and technological backgrounds can benefit. Its simple interface and structured feedback system make the platform practical and effective across diverse learning environments.

F. Reduction of Academic Stress and Dropouts

By aligning students' abilities with their chosen programs, PathWise helps reduce stress, dissatisfaction, and the likelihood of dropping out. At the same time, it builds confidence in decision-making and increases satisfaction with academic choices.

IV. METHODOLOGY

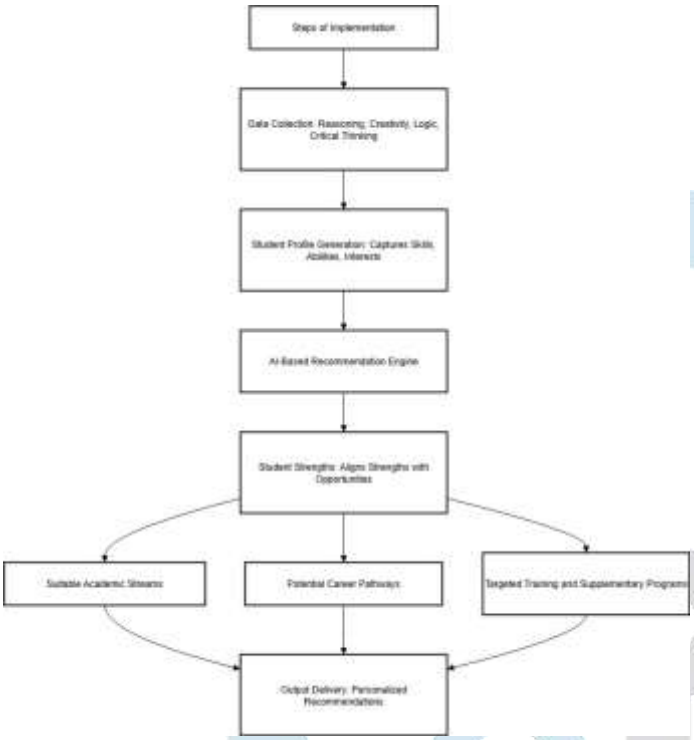

Fig. 1. System Flowchart

The system follows a clear, step-by-step process that turns student assessment results into tailored academic and career guidance. The flowchart illustrates each stage, which is described in detail below:

A. Steps of Implementation

The proposed framework is structured as a multi-stage pipeline, where each phase plays a vital role in building accurate and meaningful guidance for students. Beginning with the collection of assessment data and moving systematically toward the generation of personalized recommendations, every step is designed to add value and maintain logical continuity. This structured approach ensures that the process remains transparent, reliable, and easy to interpret, allowing students and educators to clearly understand how the recommendations are derived. By following this sequence, the system not only delivers tailored outcomes but also builds trust in the decision making process.

B. Data Collection

The first stage of the framework focuses on systematically collecting psychometric and aptitude data through validated and structured assessments. Rather than relying only on traditional academic grades, which provide a limited view of student potential, these assessments explore broader dimensions of cognitive ability. Areas such as logical reasoning, creativity, problem-solving, and critical thinking are carefully measured to capture how students think, analyse, and respond to challenges. This step provides a more holistic picture of the learner and establishes a reliable, objective foundation for building accurate student profiles in the subsequent stages of the system.

C. Student Profile Generation

The data gathered in the earlier stage is carefully integrated to create a comprehensive student profile. This profile goes beyond surface-level information, capturing multiple dimensions such as skills, abilities, interests, and cognitive strengths. By consolidating diverse assessment outcomes into a unified structure, the system ensures that no single attribute dominates the evaluation. Instead, the profile reflects a balanced and multi-faceted view of the learner's intellectual and personal characteristics.

In this way, the student profile becomes the foundation upon which the entire recommendation process is built. It not only highlights individual strengths but also identifies potential areas for improvement, offering a holistic understanding of the learner's capabilities. This structured representation guarantees that the subsequent recommendations—whether academic streams, career pathways, or supplementary training—are grounded in a complete and accurate view of the student.

D. AI-Based Recommendation Engine

The generated student profile is then processed through a sophisticated machine learning framework that employs Decision Trees, Random Forests, and rule-based systems to ensure both accuracy and interpretability. The engine systematically analyses the student profile against a comprehensive knowledge base containing academic programs, career opportunities, and emerging professional pathways. Rather than employing simple one-to-one matching, the system adopts a multidimensional approach that identifies primary recommendations closely aligned with student strengths while simultaneously exploring alternative pathways that may offer unexpected opportunities. This design ensures that the recommendation process remains transparent, adaptable, and capable of providing comprehensive guidance that considers both conventional and innovative career directions for each student.

E. Aligning Strengths with Opportunities

Following the recommendation generation, the system performs a critical alignment process that bridges the gap between student capabilities and real-world opportunities. This stage systematically maps the identified intellectual strengths, cognitive abilities, and personal interests against available academic streams, career pathways, and supplementary training programs. The alignment mechanism goes beyond surface level matching by analysing the synergy between a student's natural aptitudes and the demands of various opportunities, ensuring that recommended pathways are not only academically suitable but also personally fulfilling and professionally viable. This strategic alignment process helps identify options that leverage the student's inherent strengths while maintaining realistic expectations about achievability, ultimately providing students with meaningful choices that can sustain long-term motivation and career satisfaction.

F. Output Categories

The recommendation system delivers personalized guidance through three interconnected categories that collectively address the student's academic and professional development journey:

- Suitable Academic Streams: Educational programs and disciplines that align with the student's cognitive strengths, learning preferences, and academic capabilities.
- Potential Career Pathways: Professional trajectories that complement the student's abilities, interests, and aspirations, including both traditional and emerging career options.
- Targeted Training and Supplementary Programs: Specific courses, certifications, or development initiatives that address identified skill gaps and enhance the student's preparedness for their chosen academic or career direction.

G. Output Delivery

The culminating phase focuses on presenting the comprehensive recommendations through an intuitive and user friendly interface that ensures clarity and comprehension. The system consolidates all generated insights into a well structured, personalized roadmap that goes beyond merely listing suggested pathways by providing detailed rationale for each recommendation. This explanatory approach demystifies the decision-making process, offering students transparent insights into how their unique profile connects to specific opportunities. The structured presentation format is designed to minimize confusion and overwhelm while simultaneously building student confidence in their potential, ultimately empowering them to make well-informed academic and career decisions that align with their long-term goals and personal aspirations.

V. Conclusion

PathWise marks a notable step forward in AI-powered educational guidance, specifically tackling the challenge that many Grade 12 students face when choosing their academic paths. By combining detailed psychometric assessments with transparent machine learning techniques such as Decision Trees, Random Forests, and rule-based systems, the platform creates comprehensive student profiles that reveal strengths across multiple areas, including arithmetic, logical reasoning, critical thinking, and creativity.

Unlike traditional methods that rely heavily on subjective self-assessments or generic aptitude tests, PathWise offers personalized, data-driven recommendations. It aligns each student's abilities with suitable academic streams, career options, and supplementary learning opportunities, all while providing clear explanations behind each suggestion. This focus on transparency helps students and counsellors feel confident in the decisions being made.

Designed with inclusivity and accessibility in mind, PathWise can be used by students from diverse socioeconomic and technological backgrounds. By systematically matching students' strengths with appropriate opportunities—and suggesting alternative pathways when gaps are identified—the platform overcomes many limitations of conventional guidance methods. In doing so, it has the potential to reduce academic stress, prevent course-career mismatches, and lower dropout rates. Ultimately, PathWise empowers students to make informed choices that reflect their abilities, interests, and long term career goals.

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