# Project Plan

This project aims to explore and address the inefficiencies in the current university placement system by developing an algorithm that integrates academic, personal, and socioeconomic data to recommend suitable courses for high school graduates. The primary research question is: "How can a data-driven algorithm improve the accuracy and satisfaction of university course placements for high school graduates?"

Current systems often neglect holistic factors like personality traits, talents, and socioeconomic contexts, leading to mismatches in career paths and wasted resources.
This research is grounded in the belief that education systems must evolve to better serve individual needs while contributing to societal productivity. By incorporating modern data science tools and action research methodologies, this project intends to offer a transformative approach to course placement that emphasizes equity, efficiency, and student satisfaction.

## Proposed Solution

### Overview of the Algorithm

The proposed algorithm is designed to offer a more holistic and personalized approach to university course placements. Compared to an algorithm used in New South Wales university, Richard (2024, p. 1) states that the algorithm would strive to create stable matches between students and courses, ensuring that no student would prefer another available course over their allocated course based on their academic, personal, and socioeconomic data, and no institution would prefer another student with higher suitability to the course.The input data is designed to be holistic. It integrates three key dimensions:

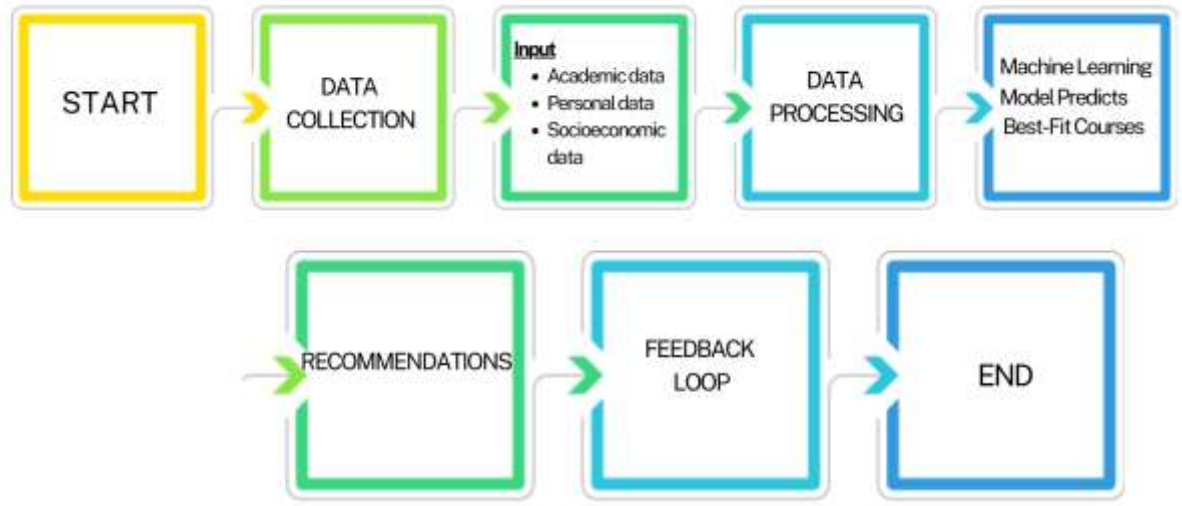
1. **Academic Data**: Includes grades, standardized test scores, and subject preferences.
2. **Personal Characteristics**: Considers personality traits, hobbies, and talents based on psychometric assessments and interest surveys.
3. **Socioeconomic Background**: Accounts for factors like family income, geographic location, and access to educational resources. (Monsuni 2021, p. 1) used interesting variables as stated in the article: employability", "unemployment", "passion for the job", "number of schoolmates", "jobs in Italy", "jobs abroad

### Technological Approach

- **Data Collection**: A user-friendly interface allows students to input their details, while data from academic records and surveys is securely collected.
- **Machine Learning Model**: The algorithm employs supervised learning to analyze historical data, combined with clustering techniques to identify unique student profiles and match them to courses.

- **User Interface**: A web and mobile platform enables students to interact with the system, view course recommendations, and explore the rationale behind the suggestions for transparency.

Below is a prototype flowchart of what we intend to achieve:




**Strategic Benefits**

1. **Improved Student Satisfaction**: By aligning courses with individual strengths and aspirations, students are more likely to thrive academically and emotionally.
2. **Efficient Resource Allocation**: Reduced dropout rates and fewer cases of students pursuing additional degrees optimize educational resources and funding.
3. **Enhanced Societal Productivity**: When students enter fields suited to their skills and passions, they contribute more effectively to the economy and innovation in their chosen professions.

This solution not only addresses the limitations of the current system but also paves the way for a future where education systems prioritize personalization and inclusivity.

**Strategic End Goals**

**Cycle 1 (Implementing Change):**
Develop and test a prototype algorithm that integrates academic records, personality assessments, and socioeconomic factors.

**Cycle 2 (Organisational Transformation):**
Refine and deploy the algorithm within an education ministry or institution, facilitating widespread adoption and influencing policy-level changes.

**Methodology**

The research will be conducted using a mixed-methods approach:

1. **Data Collection:** Gather historical placement data, survey results from students, and input from stakeholders.
2. **Exploratory Analysis:** Identify patterns and correlations in the data.
3. **Algorithm Development:** Design and implement a machine learning model incorporating multi-dimensional data.
4. **Iterative Testing:** Test the algorithm with a pilot group and refine based on feedback.

**Justification for Methodology**

A mixed-methods approach enables the integration of qualitative and quantitative insights. This methodology supports a holistic understanding of the problem, fosters collaborative engagement with stakeholders, and ensures practical and actionable outcomes (Fetters & Freshwater, 2015).

**Limitations**

Because we would use historical data, historical data is prone to bias that could possibly skew results (Mertens, et al., 2020). Conducting mixed methods research is not easy and involves several barriers (Creswell & Plano Clark, 2011). This is because they require more work and financial resources, and they take more time in implementing the quantitative and qualitative parts of the study.

**Ethical Considerations**

1. **Data Bias**:
    - Bias in historical data (e.g., gender or socioeconomic disparities) will be addressed through balanced data sampling and fairness metrics during model training.
2. **Privacy Concerns**:
    - Strict data anonymization and encryption protocols will be employed to protect student and stakeholder data.
    - Compliance with legal and ethical guidelines, such as GDPR or local data protection laws, will be ensured(Mark .V.R., p. 1).

**Stakeholders**

The target market for the proposed algorithm-based university course placement system includes the following segments:

**1. Primary Target Market**

- **High School Students**:
  Students in their final year of high school who are about to make decisions regarding

university courses. They are the direct users of the algorithm, benefiting from personalized and data-driven course recommendations.

- **Parents/Guardians**:
  Parents and guardians who guide their children in selecting courses and universities. They are stakeholders in ensuring that students make informed choices aligned with their interests and capabilities.

**2. Secondary Target Market**

- **Educational Institutions**:
  - **High Schools**: Counselors and career guidance departments can use the system to assist students in identifying suitable courses based on their holistic profiles.
  - **Universities and Colleges**: Institutions can benefit from receiving better-matched students who are likely to excel and complete their programs, improving retention rates.
- **Government and Educational Policy Makers**:
  Ministries or departments of education can adopt the algorithm as part of national course placement programs to enhance efficiency and equity in educational systems. Currently for instance in Kenya, the criteria used mainly focuses on the available slots in the universities and the students choices which was limited by his/her performance (Irene Mwangi, 2023).

**3. Tertiary Target Market**

- **Corporate Sector**:
  Companies and industries seeking to align educational outputs with workforce demands can leverage insights from the system to predict future skills gaps.
- **Educational Technology Platforms**:
  Companies offering online learning or career development tools may integrate the algorithm as an additional feature to enhance their offerings.

By targeting these groups, the algorithm can create a ripple effect of benefits, improving student satisfaction, optimizing institutional resource allocation, and ultimately contributing to societal productivity.

## Suggested Timetable

The schedule below is a draft and will likely be refined as the development process continues but this is the first draft.

| Phase | Activity | Timeline | Milestones |
|---|---|---|---|
| **Phase 1: Planning** | Define project objectives, scope, and deliverables | Week 1 | Approval of project proposal |
| | Create project proposal and plan | Week 2<br>Week 3 | Finalize background research and problem statement |
| | Identify stakeholders and form a project team | Week 4 | Stakeholder engagement completed |
| **Phase 2: Data Collection** | Gather historical records and academic performance data | Weeks 5–7 | Data collection phase completed |
| | Design and distribute surveys for qualitative feedback | Weeks 8–9 | Survey results compiled |
| **Phase 3: Algorithm Development** | Develop the initial algorithm model | Weeks 10–13 | Prototype algorithm ready for testing |
| | Refine algorithm based on feedback | Weeks 14–16 | Optimized algorithm completed |
| **Phase 4: Testing and Validation** | Pilot testing of the algorithm with sample data | Weeks 17–18 | Pilot results analyzed |

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| | Collect feedback from users and stakeholders | Week 19 | Feedback incorporated into the algorithm |
| **Phase 5: Implementation** | Deploy the algorithm within a controlled environment | Weeks 20 | Algorithm successfully deployed |
| **Phase 6: Evaluation** | Monitor performance and collect post-deployment data | Weeks 21–22 | Evaluation report completed |
| | Final adjustments based on evaluation findings | Week 23 | Finalized algorithm |
| **Phase 7: Reporting** | Document results, lessons learned, and recommendations | Week 24 | Final project report submitted |
| **Phase 8: Dissemination** | Present findings to stakeholders and policymakers | Week 24 | Project presentation completed |

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