

**ENHANCING EDUCATIONAL ALIGNMENT: DEVELOPING A COMPREHENSIVE  
ALGORITHM FOR COMPLEMENTING PERSONALIZED COURSE PLACEMENT IN  
KENYA.**

**JOY MACHUKA**

**AN ACTION RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF  
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## Declaration

I Joy Machuka hereby declare that this research project is my original work and has not been presented for a degree in any other university I know of.

Signature ..... Date .....

Joy Machuka

This research project has been submitted for examination with my approval as the University Supervisor.

Signature ..... Date .....

Leonidas Souliotis

Signature ..... Date .....

Steve Marshall

## Dedication

I dedicate this project to my family; mum and dad for their unfailing all-round support, constant encouragement and prayers during the period of undertaking this master's degree.

## Acknowledgement

This project would not have been possible without the Almighty God's providence of time and resources....

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## Project Summary

Choosing a university course is one of the most crucial decisions one would make. This is because this shapes career trajectories and life's fulfilment. Of course, one could change career trajectories midway. Sometimes the transition is smooth, sometimes it comes at a cost of wasted time and resources. However there's never really a right course, but I'd like to think that there's the best fit course that aligns with ourselves and is most likely to bring more positive results. Unfortunately, the current system, at least for Kenya is primarily based on national exam grades and a limited list of course preferences. This often results in mismatched placements. Students are most times forced to adapt to the given courses. Some adapt quiet well and take off successfully, but for some they struggle in vain and eventually are forced to change course.

To address this challenge, this project is focused on designing, developing, and testing an inclusive course placement algorithm to complement the selection process. The algorithm employs an all-round data driven approach that integrates diverse factors such as the student's academic performance, hobbies, personal interests, socioeconomic factors and behavioural traits, to recommend courses that best align with each student's unique profile.

Ultimately, the aim of the project is to provide a solution by developing an algorithm that complements students, parents, guardians, and educational institutions in making informed course selection decisions. The project is to be implemented using the agile software development methodology to ensure iterative design, feedback incorporation, and continuous improvement. By minimizing mismatched placements, the algorithm seeks to optimize resource utilization, enhance student satisfaction, and contribute to the overall productivity and effectiveness of the education system.

## Chapter 1: Introduction

Who or what decides how our life pans out? Do we strategically plan our lives or we just go by the wind. I tend to believe that it's a bit of both. We can't always have life go our way. If that were the case, the world would be one happy place. In most cases, our life's plan involves a career. For some, it's defined by talent; for others, entrepreneurship or education, leading us to our focus - careers.

This project stems from personal experiences that exposed flaws in Kenya's education system. A friend pursued two bachelor's degrees due to an initial misalignment. She started with law but lost interest midway and later pursued computer science, her true passion. She fit in perfectly in tech but this came after incurring losses; both financial and emotional costs. This was caused by the ineffective placements. Secondly, I helped my sister select courses. We were to only consider her grades and preferences, neglecting other critical factors. This really limited us and put us in a box. Last but not least, my experience with self-development courses further affirmed that we thrive when doing what we love. What better way to boost career productivity than pursuing a course aligned with your passion? This ultimately enhances national productivity.

This has created in me a desire to ensure that less or no student is affected by the limitations of the current system. The need for some sort of change in the system is undeniable.

Throughout this study, I will use data science to complement this placement process. In my opinion increasing productivity is the leading motivating factor because it in turn increases the country's productivity. These experiences inspired the idea of a comprehensive placement algorithm, one that factors in academic, social, and personal elements. That way, there is hope that such a system would reduce the number of mismatches, placing students on a right track.

The university placement system in Kenya, primarily based on the Kenya Certificate of Secondary Education (KCSE) exam results, has significant limitations in ensuring equitable access to higher education. The current placement is based on KCSE performance and availability of university program slots. However, this often overlooks important factors such as personal talents, cumulative academic performance over the school years, students' skills and even possibly socio economic factors. Many students miss out on their preferred courses despite meeting the requirements due to limited university capacity. While interuniversity transfers are possible, the process is complex and favours self-sponsored students (Nation,

2021). This leads to academic dissatisfaction, disengagement, wasted resources and in some cases, failure to complete their education. Concerns over mismanagement of placement data have even been raised in parliament (Thiong'o J. - The Standard, 2024). Following the 2024 KCSE exams, panic arose due to placement uncertainties. This is because it is a common problem for many students to get courses they did not select or even miss placement. Further fuelling the anxiety is failure by the then education minister to communicate the selection process (Nyaundi L. - The Standard, 2025).

The general objective of this study: to design and develop an integrated algorithm that leverages comprehensive data, including cumulative academic records, personal interests, behavioural traits and possibly socioeconomic factors to recommend the most suitable courses for students therefore complementing the existing placement process.

The research questions include identifying key factors influencing career choices, which ultimately determine university course selection. Thereafter, the study explores how these factors can be integrated into a useful model. The goal is to develop an algorithm that balances students' aspirations, abilities, and personalities for better course recommendations to complement the existing model. Finally, I intend to compare this proposed system's effectiveness with the current one.

Feedback from my lecturers raised questions, such as, "What is the future of good education?" and "Who decides what is good?" This led me to shift my perspective and drive this study as a complementary solution rather than a definitive one. Moreover, the study is on ensuring that the algorithm provides accurate, fair, and well-rounded recommendations. The developed integrated tool uses machine learning techniques and a data-driven approach, which enabled the system to analyse historical student performance, identify trends, and suggest courses that align with individual strengths and aspirations. The study is limited by the availability of comprehensive digital student data. This is because some institutions may not have complete digital records. Similarly, not every school in the country embraces digital records for every exam. Additionally, the algorithm might not adequately account for the unpredictably shifting career goals of students over time.

The stakeholders include primary stakeholders – the high school students and their parents or guardians. Students are my immediate audience.



The secondary stakeholders include educational institutions, universities, and government policymakers. All these can adopt the algorithm to enhance efficiency in course placements.

The tertiary stakeholders involve the corporate sector and educational technology platforms. Companies can use insights from the system to align education with workforce demands.

As the developer, I play a crucial role as a tertiary stakeholder in ensuring the algorithm remains fair, transparent, and effective. My work directly impacts students, institutions, and industries. My role involves engaging with various stakeholders to understand their needs.

At the start of this project, I am taking on a leadership role by driving the vision and development of the algorithm. So far I have had the task of justifying to my lectures and colleagues on the necessity of this study. I plan to actively interact with one high school that I am affiliated to- so as to gather insights on their challenges with course selection. I will also collaborate with educational institutions and policymakers to align the system with national education goals.

My core values so far have been fairness, transparency, and data-driven decision-making. I believe every student deserves a placement that aligns with their strengths and aspirations. Through this initiative, I hope to create a meaningful impact by reducing misplacements, improving career satisfaction, and enhancing productivity.

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