AI-Powered Tutor (Adaptive Learning System) with Community Support: Improving Technical Skills and Career Outcomes of Low-Income University Students in Brazil

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1 Introduction

Country Overview

Brazil is the largest country in Latin America, with high diversity in geography and culture (Schneider et al., 2024). Portuguese is the official language. Brazil has extreme social and wealth inequalities, and many Brazilians (68 million) lack basic schooling (Schneider et al., 2024). About 80% of the Brazilian population have access to the internet (World Bank, 2024), and the Brazilian government aims to connect all schools in Brazil to the internet by 2026 (Vanoi, 2023). There is growing unmet demand for skilled technical labor in information and communication technologies (Osava, 2024).

Higher education traditionally has been accessed by the wealthy, particularly the competitive and prestigious free public universities (Schneider et al., 2024). As demand for university increased dramatically, about three-fourths of undergraduates in Brazil attended private institutions, despite the financial burden (Schneider et al., 2024). Private universities are focused on meeting the professional requirements of the labor market and have developed flexible programs to meet the needs of the working population ("Brazil Education," ITA, 2023). Many university students do not graduate on time or at all (OECD, 2023).

ICT Market

The Brazilian information technology market was valued at $45.2 billion in 2022 ("ICT", ITA, 2023). "The software market is driven by security, data management, artificial intelligence (AI), and customer experience (CX) solutions, and is expected to grow 15.1% in 2023. Half of the sales in software will be Software as a Service (SaaS), projected to increase by 27.6% in 2023. Major software and services user segments include the service sector, telecom, financial services, industry, commerce, government, oil and gas, and agriculture. According to an ABES report, in 2022, spending increased the most in two user segments, government by 6.7%, and commerce by 18.3%." ("ICT", ITA, 2023).

The Brazilian government is supportive of technology development. The Brazilian Strategy for Artificial Intelligence (EBIA) aims to "contribute to the development of ethical principles for the progress and use of responsible AI; promote sustained investments in AI research and development; remove barriers to innovation in AI; encourage Brazilian AI innovation and development in an international environment; and promote an environment of cooperation between public and private entities and industry and research centers for the development of AI" ("ICT", ITA, 2023). The field of AI in Brazil is growing and is expected to exceed $1 billion in spending in 2023 (33% increase year-over-year)" ("ICT", ITA, 2023).

Similar Projects

Popular online learning platforms in Brazil include Plurall and Coursera, which teach basic and niche subjects ("ICT", ITA, 2023). Mindspark.in is a personalized learning software that teaches math, science, and English. There are online websites that teach coding, such as

codeacademy.com. Khanacademy.org offers for a fee its AI-based chatbot Khanmingo that answers students' questions. Trybe is an edtech startup in Brazil that offers a coding bootcamp and gets payment from students if they get high paying jobs (Global-Edtech, 2020). Our program combines various features of these products by offering an affordable and adaptive learning system tailored to universities' needs.

2 Program/project overview

Rationale for the project:

This initiative aims to narrow the gap between low-income students in Brazil and the thriving IT sector by providing them with access to world-class coding education. Focusing on AI-based teaching methods, particularly in Python and data science, our program seeks to equip students with the technical acumen necessary to secure lucrative, remote software engineering positions or to pursue entrepreneurial endeavors in the tech field. Through the use of AI-driven learning platforms and hands-on problem-solving experiences, our project seeks to cultivate proactive contributors to Brazil's digital economy.

Our goals are to provide accessible and personalized coding education to low-income students, foster the acquisition of technical skills in Python and data science to meet the demands of Brazil's IT job market, and instill a culture of innovation and entrepreneurship among students. We also aim to strengthen the link between academia and industry by tailoring learning experiences to meet industry-specific needs.

Through these efforts, we expect to increase the employability and earning potential of low-income students, expand remote work opportunities and tech entrepreneurship initiatives in Brazil, and increase collaboration between academia and the IT industry to address skills gaps and spur economic development.

Target population:

Our primary beneficiaries are low-income students and vulnerable populations in Brazil, particularly those enrolled in rural universities. By partnering with universities, we aim to reach students who are prevented from accessing quality coding education due to financial constraints or geographical barriers.

Our customers are university professors. In today's labor market, there is a demand for understanding data analysis, programming languages, and related skills. Faculty members comprehend this and desire for students to effectively acquire data analytics skills that are relevant to their majors.

Our main beneficiaries (end users) are low-income students and vulnerable populations in Brazil, especially those enrolled in rural universities. By partnering with universities, our aim is to support students facing difficulties in accessing high-quality coding education due to financial

constraints or geographical barriers. Through this collaboration, we aim to empower them to acquire skills that can lower the barriers to high-income professions.

Program Components:

Motivation:

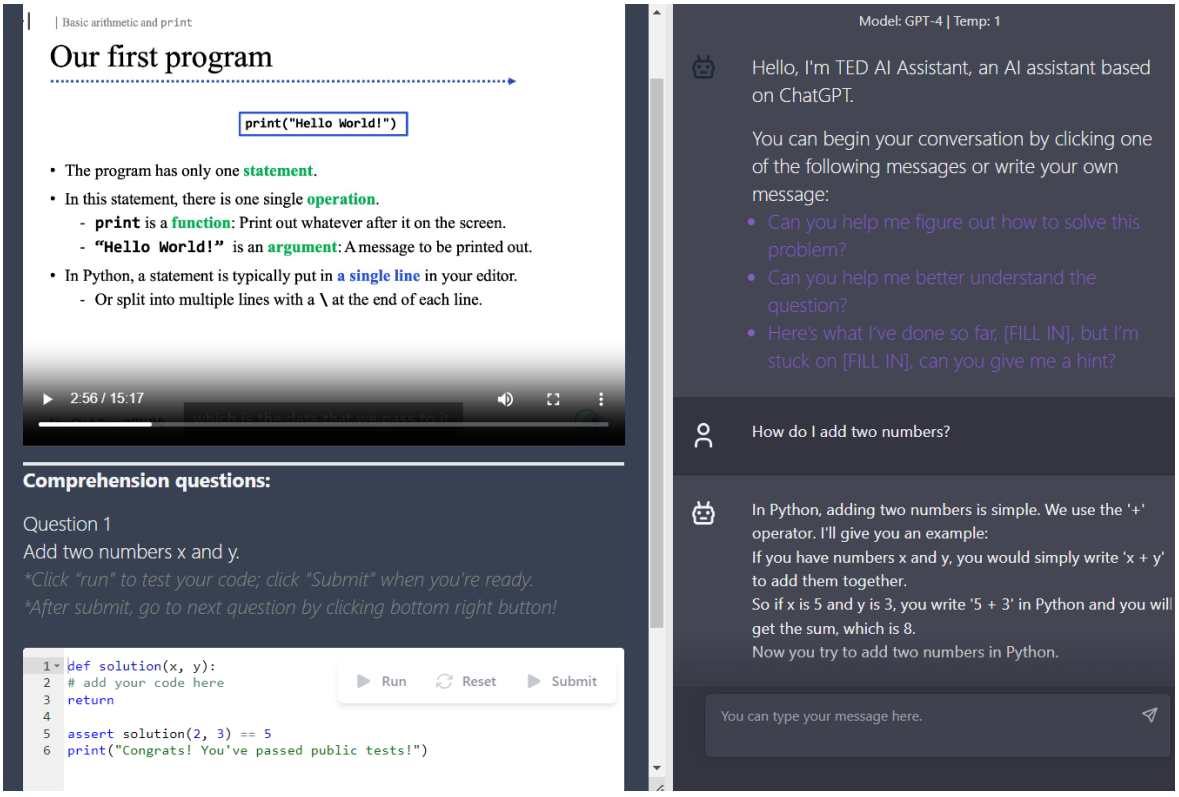
To inspire and motivate students, we will conduct interviews with experienced professionals in the coding industry. In addition, we will assess students' needs and aspirations to tailor the program to their individual interests and career goals.

Learning Skills:

Our program utilizes an AI-powered learning platform that offers video sessions for theoretical learning and interactive coding exercises. Tailored to each major data, such as Forestry, Business, Engineering, and Medicine, the platform guides students through coding exercises relevant to their field of study.

Upon completion of the final module, students will showcase their learning through the execution of a final project, which will entail conducting a data analysis utilizing data relevant to their specific field of study.

Adaptive learning algorithms personalize the learning experience based on individual progress, and 24/7 AI tutor support is available to help students overcome challenges and reinforce key concepts.



Networking:

Promote knowledge sharing and collaboration among students to cultivate a supportive community within their major or specific industry. Encourage active participation in networking activities, such as sharing code and exploring job prospects within their respective fields.

3 Project risk and mitigation

Dependency on Wharton's AWS Support:

Risk:

Our project relies on the utilization of AWS services provided by Wharton School, facilitated through a program initiated by Angel Chung, a PhD candidate at Wharton. While we currently incur no additional costs beyond personnel expenses, there's a risk associated with dependency on this support. If Wharton's assistance with AWS is discontinued in the future, it could potentially disrupt our program delivery.

Mitigation:

To address this risk, we must develop contingency plans. This involves proactively seeking alternative AWS support options or exploring alternative cloud service providers. By diversifying our options, we can ensure uninterrupted program delivery, safeguarding against potential disruptions.

AI Integration Challenges:

Risk:

Integrating AI into classroom settings may present challenges, including potential resistance from faculty or students. There may be difficulties in effectively incorporating AI as a supplementary tool for learning.

Mitigation:

To mitigate this risk, we propose providing comprehensive training and support for both faculty and students on AI utilization. This includes highlighting the benefits of AI as a supplementary educational tool to enhance learning outcomes. Additionally, AI can provide round-the-clock assistance, offering instruction and guidance to students whenever they require support, thereby easing the integration process.

4 Implementation Arrangement/Model

Step 1: Initial Pilot Implementation

1. University Selection:

Identify a pilot university in Brazil, preferably in a rural area, offering a new sector relevant to the program. For instance, consider partnering with the Forestry program at the University of Uberlandia.

2. Collaboration with the University:
Engage university stakeholders, including faculty members and department heads, to introduce the coding education program and explore implementation strategies. Offer intervention options such as integrating coding assignments into formal classes, conducting formal or informal classes with professor supervision, or providing individualized training sessions.

3. Curriculum Integration:
Collaborate closely with faculty members to identify suitable topics and assignments within relevant courses where coding skills can be incorporated. Develop guidelines and materials to support the integration of coding exercises and projects into the existing curriculum structure.

4. Faculty Training and Support:
Conduct training sessions to familiarize faculty members with the coding education program, teaching methodologies, and available resources. Provide ongoing support to address technical issues and offer guidance on effective teaching strategies throughout the program implementation.

Step 2: Evaluation and Data Collection

1. Surveys and Feedback:

Administer surveys to students enrolled in the pilot program to gather feedback on their experiences, satisfaction levels, and perceived learning outcomes. Include questions assessing the effectiveness of coding exercises, engagement with the material, and challenges encountered during the course.

2. Data Analysis:

Analyze survey responses and relevant data collected during the pilot program to evaluate the impact of the coding education program on students' coding skills and understanding of forestry-related data analysis concepts. Utilize both quantitative and qualitative methods to identify trends, patterns, and areas for improvement.

Step 3: Expansion and Scaling

1. Sharing Successes:

Compile the findings from the evaluation and data analysis into a comprehensive report showcasing the successes and key learnings from the pilot program. Share the report with other universities offering similar majors to demonstrate the value and relevance of the coding education program.

2. Initiate Discussions:

Reach out to administrators and faculty members at other universities to initiate discussions about adopting the coding education program.

Present the positive outcomes and testimonials from the pilot program to generate interest and support for program expansion.

3. Customization and Implementation:

Work collaboratively with each university to tailor the program implementation to their specific needs, resources, and constraints.

Provide guidance and support throughout the implementation process, including curriculum integration, faculty training, and student support services.

By following these steps, the project can effectively pilot, evaluate, and scale the coding education program within the relevant major at various universities, thereby expanding access to technical education for low-income students in Brazil. This implementation process facilitates both vertical expansion within existing majors and horizontal expansion as new majors or fields (e.g., medicine, civil engineering, chemistry, business) are established in the future.

5 Feasibility and Sustainability strategy

By adopting a holistic approach that addresses feasibility and sustainability considerations, we can ensure the long-term success and impact of the project in improving the technical skills and career outcomes of low-income university students in Brazil.

Resource Allocation

While the project has a very low cost (about $5000 for the first year and maintenance costs thereafter), ensuring the availability of financial and human resources to continue operating in the future is essential for the feasibility of the project. We will seek funding from a variety of sources, including grants, corporate sponsorships, and partnerships with government agencies. Additionally, it is important to leverage the expertise of faculty, AI experts, and educational technologists for the successful implementation of the program.

Scalability

Designing the program with scalability in mind is critical for long-term sustainability. This program has a very robust structure for scalability. By starting a pilot implementation at a single university and gradually expanding to additional institutions, you can improve the program based on feedback and ensure its effectiveness in different contexts. This step-by-step approach allows you to scale the program while maintaining quality and relevance.

Community Engagement

Building a strong community of stakeholders, including students, faculty, industry experts, and policymakers, is key to project sustainability. Regular communication, feedback mechanisms,

and collaboration opportunities foster ownership and commitment among all stakeholders to ensure continued support for the program.

Partnerships and Collaborations

Collaborations with universities, industry partners, and government agencies allow us to leverage existing resources, networks, and expertise to enhance program sustainability. By building strategic partnerships, we can access additional funding, resources, and opportunities for program expansion. Additionally, partnerships with communities and organizations will ensure that our programs are relevant and responsive to the needs of low-income students.

Monitoring and Evaluation

Implementing robust monitoring and evaluation mechanisms will allow us to assess the impact of our programs and make data-driven decisions for continuous improvement. Regular monitoring of key performance indicators such as student retention, learning outcomes, and employment rates can provide insight into the effectiveness of your program and identify areas for improvement. Additionally, conducting regular evaluations that include stakeholders will ensure that your program continues to respond to changing needs and challenges.

6 Conclusion

In conclusion, investing in our project holds significant rewards for both low-income university students in Brazil and the broader society, alongside a high probability of success.

By providing accessible coding education to low-income students, we are not only equipping them with valuable technical skills but also opening doors to lucrative career opportunities in the thriving IT sector. Through personalized learning experiences and hands-on problem-solving, students can develop the expertise needed to secure remote software engineering positions or pursue entrepreneurial ventures in the tech field. This not only enhances their employability but also empowers them to contribute actively to Brazil's digital economy, fostering innovation and economic growth.

Furthermore, our project fosters collaboration between academia and industry, ensuring that educational programs are aligned with the evolving needs of the IT job market. By partnering with universities, industry professionals, and government agencies, we can leverage existing resources and expertise to enhance program sustainability and scalability. This collaborative approach not only strengthens the link between education and employment but also promotes knowledge sharing and innovation within the tech industry.

In terms of probability of success, our project is built on a solid foundation of research, stakeholder engagement, and strategic planning. With a clear understanding of the challenges

faced by low-income students and a comprehensive strategy to address them, we are well-positioned to achieve our goals and make a lasting impact. Additionally, the support from various stakeholders, including universities, industry partners, and government agencies, underscores the feasibility and potential of our project.

In summary, investing in our project offers significant social and economic returns, including enhanced employability, increased innovation, and greater economic prosperity. With a robust plan in place and strong support from stakeholders, the probability of success for our project is high, making it a worthwhile investment in the future of low-income university students in Brazil.

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The group members' contributions are as follows:

Angel Chung: Provided product and technical advice and contributed to the development of training programs.

Eunbin Kim: Authored the development of the program/project overview, Project risk and mitigation, Implementation Arrangement/Model, Feasibility and Sustainability strategy, and Conclusion sections.

Kiyeon Lee: Conducted literature review, authored Introduction, compiled references, and contributed to the Program/project overview section.

All members reviewed and provided feedback on the final paper text.