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## MASTER OF APPLIED COMPUTING

## COMP 8157 ADVANCED DATABASE TOPICS

## **PHASE 2: PROJECT MILESTONE**

### **GOAL 4: QUALITY EDUCATION**

**Addressing Educational Disparities: Assessing the Gap for Indigenous Community**

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| **Group 3** | |
| **Abhirup Ranjan** | **110091866** |
| **Anika Anjum Una** | **110097185** |
| **Neel Manish Pandya** | **110095825** |
| **Viutika Rathod** | **110094621** |

# **Abstract**

This paper proposal aims to address the continual disparities in education faced by Indigenous students in Canada through the utilization of exhaustive inspection and analysis of Indigenous Data Management [1]. Factors such as historical trauma, socio-economic challenges, cultural limitations, prejudice, and a lack of support networks contribute to high dropout rates among Indigenous students. The underlying concern revolves around persistent inequality in resource allocation and funding for their schools and communities, limiting opportunities for effective education. To tackle these challenges, our management system proposes a distinctive solution by creating a detailed system that includes tailored data collections using non-relational databases. This system will account for cultural identity, language proficiency, and community involvement, providing an integrated knowledge of students' experiences and challenges [2]. By incorporating Indigenous data governance principles, we assure ownership and control of the data to the community. The utilization of a NoSQL database is crucial in handling the vast amount of government-provided data encompassing various details, such as individuals' names, ages, genders, indigenous categorizations, educational attainment levels, addresses, and employment sectors. Leveraging this comprehensive dataset enables the determination of factors contributing to higher dropout ratios in specific regions. Additionally, in-depth analyses, including the examination of gender-based dropout ratios, can be performed [3]. These valuable insights not only aid government agencies in devising strategies for future welfare development in targeted regions but also enable the early identification of children at risk of dropping out of school. The goal of this paper is to empower Indigenous societies, enhance educational equity, and assist in closing the educational gap for Indigenous students in Canada.

# **Introduction**

The Indigenous communities in Canada experience significantly higher dropout rates compared to non-Indigenous communities, attributed to a range of factors such as historical and intergenerational impacts, financial inequities, social marginalization, lack of support systems, and geographic barriers [4]. These factors restrict access to quality education for Indigenous students, resulting in lower educational achievements compared to the general population of Canada [6].

## **Problem Description**

When we outline the problem of educational disparities faced by Indigenous students in Canada, we face factors such as the legacy of colonialism, residential schools, racism, and insufficient funding hinder access to post-secondary education, which is recognized as a treaty right for Indigenous students. Funding inadequacy and access difficulties contribute to a significant disparity in educational opportunities [5]. Also, lack of necessary infrastructure has hindered the distribution of culturally relevant educational curricula to Indigenous communities [7]. Teaching practices in non-Indigenous institutions need refinement, focusing on incorporating Indigenous history, cultures, perspectives, and addressing racism and marginalization [8].

**Motivation**

Our work is motivated by deep understanding of past injustices and current hardships faced by Indigenous communities. We aim to address the lack of cultural responsiveness in the mainstream educational system and promote justice, fairness, and reconciliation [9]. By embracing empathy and recognizing the generational effects of policies like the residential school system, we seek to restore pride, dignity, and self-respect among Indigenous children [10]. Through cultural responsiveness, we aim to foster respect, understanding, and inclusive education for all students.

**Solution Statement and Technology Used**

Our objective is to bridge the educational gap between Indigenous and non-Indigenous populations in Canada by addressing issues such as insufficient funding, cultural disconnection, discrimination, and lack of support systems for Indigenous communities. We aim to assess and analyze the quality of education for Indigenous students, promote evidence-based decision-making, and ensure educational equity. Integrating Indigenous knowledge systems, languages, and histories into the curriculum is a key focus, empowering Indigenous students and improving the educational experience for all.

To achieve our goals, we propose a model that utilizes a NoSQL database, like MongoDB, to address educational disparities faced by Indigenous students. This model will capture unique information such as cultural identity, language proficiency, community involvement, and demographics, while adhering to Indigenous data governance principles. It will enable comprehensive data integration from various sources, evaluating the success of educational initiatives and facilitating timely support and prevention of widening educational gaps. The chosen NoSQL database ensures data privacy and security, aligning with ethical principles and relevant laws. There is a lack of published papers specifically addressing our identified issue, making our project unique. Through our comprehensive model and data-driven approach, we aim to contribute to the development of effective strategies and policies that empower Indigenous students and bridge the educational gap in Canada.

# **Literature/ Background Study**

This research paper examines the integration of Indigenous knowledge in conservation education within the context of reconciliation in undergraduate education in Canada. Building upon previous work, the paper explores the existing problems and proposed solutions discussed by other researchers regarding the incorporation of Indigenous perspectives and knowledge systems in environmental and conservation studies. The significant contribution of this study lies in its focus on the application of Indigenous knowledge specifically in the field of conservation, highlighting the importance of incorporating Indigenous perspectives to foster reconciliation and advance sustainable practices [11]. However, a limitation of this model could be the potential challenges associated with effectively integrating Indigenous knowledge within existing curricula and ensuring cultural sensitivity and authenticity in its implementation.

This research paper critically examines the process of indigenizing engineering education in Canada by building on previous work and exploring the problems, existing solutions, and proposed approaches discussed by other researchers. The significant contribution of this study lies in its comprehensive analysis of the challenges faced in integrating Indigenous perspectives and knowledge into engineering curricula and the proposed strategies to address these issues. The authors delve into the need for decolonizing engineering education, emphasizing the importance of incorporating Indigenous ways of knowing, promoting community engagement, and fostering cultural sensitivity [12]. However, a limitation of their model could be the potential resistance or lack of institutional support, which may hinder the full implementation of indigenization efforts in engineering programs.

This research paper presents a systematic literature review on the use of digital technology to enhance language and literacy skills for Indigenous people. It builds upon previous work by examining the problems, existing solutions, and proposed approaches discussed by other researchers in the field. The significant contribution of this study lies in its comprehensive analysis of the effectiveness and impact of digital technology in supporting language and literacy development among Indigenous communities. The authors highlight the potential of digital tools, such as mobile applications and online resources, to provide accessible and culturally relevant learning opportunities. However, a limitation of their model or approach could be the reliance on digital infrastructure and access to technology, which may pose challenges in remote or underserved Indigenous communities where reliable internet connectivity may be limited [13].

All these studies focus on the integration of indigenous knowledge across a range of educational contexts. The first paper, which looks at the inclusion of Indigenous perspectives in conservation education, emphasizes the value of reconciliation and sustainable practices. The challenges and potential solutions for indigenousizing engineering education are critically analysed in the second paper, with a focus on the value of institutional support and cultural sensitivity. The third paper explores the potential benefits of using digital technology to enhance language and literacy skills in Indigenous communities while also taking into account potential drawbacks related to infrastructure and accessibility. These papers acknowledge the challenges and limitations in implementing the overall goal of integrating Indigenous knowledge and perspectives in education.

# **Proposed Model**

The proposed methodology intends to solve the problem of educational dropout among the Canadian indigenous community. This approach acknowledges to create successful interventions and support systems, a thorough understanding of the factors influencing dropout rates is necessary. The model looks at a variety of socioeconomic, cultural, and educational factors to provide insight on the difficulties experienced by indigenous kids and to suggest tactics for encouraging academic achievement.

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**Fig 1.0: Workflow Diagram**

The following workflow diagram illustrates the key components and steps involved in the proposed model for understanding education dropout in the indigenous community in Canada:

**Data Collection***:* Obtaining pertinent information from a variety of sources, such as governmental agencies, academic institutions, and neighbourhood organisations, is the first stage. The database contains data on student demographics, socioeconomic situations, cultural aspects, educational resources, and academic accomplishments.

**Data Preprocessing***:* Data is cleaned, processed, and standardised for analysis during a preprocessing stage after it has been collected. Any necessary feature engineering approaches are used, and missing values are resolved.

**Exploratory Data Analysis (EDA):** EDA methods are used to glean insights from the gathered data. In this step, patterns, trends, and potential correlations between factors relevant to educational dropout are found using statistical analysis, visualisations, and data mining methods.

**Identification of Key Factors:**The model highlights the main causes of education dropout in the indigenous community based on the EDA's findings. Socioeconomic inequalities, a lack of education that is culturally sensitive, deficient support networks, or restricted access to resources are a few examples of these factors.

**Model Development***:* To forecast the chance of education dropout among indigenous students, a predictive model is constructed using machine learning algorithms. The goal of this model is to produce precise predictions for early intervention while considering the major parameters that have been identified as input variables.

**Model Evaluation***:* The developed model is assessed for performance and effectiveness using the right evaluation metrics. This step makes sure the model makes accurate predictions and may be used to guide intervention and policy-making efforts.

**Intervention and Support*:*** Targeted interventions and support systems are developed and put into place based on the insights obtained from the model. Changes in policy, the creation of curriculum that is sensitive to cultural differences, mentorship initiatives, or easier access to educational resources are a few examples of these interventions.

**Monitoring and Evaluation***:* The effects of the established interventions and support systems on lowering schooling dropout rates are regularly tracked and assessed. To adjust and enhance the interventions over time, feedback loops are set up. The suggested strategy gives a methodical approach to comprehending and resolving the problem of educational dropout in Canada's indigenous community. This methodology strives to empower indigenous students, close the achievement gap, and provide a nurturing learning environment that will support their long-term success. It does this by integrating data analysis, predictive modelling, and tailored interventions.

# **System Definition**

To address the educational disparities faced by Indigenous students and to promote evidence-based decision-making, a model would be created for which we can use a NoSQL Database i.e., MongoDB. Here are main characteristics and features of our solution.

**Customized Data Fields:**A database schema will be designed which will have a customized set of data fields that capture pertinent data unique to Indigenous students such as:

* **Cultural identity:** Cultural identity, specifically for First Nations, Inuit, and Métis communities, can be used to identify the Indigenous peoples of Canada. By understanding their cultural identities, the government can determine the percentage of individuals belonging to each specific identity. With this information, the government can then develop appropriate strategies to improve educational opportunities for these communities.
* **Language proficiency:** Language proficiency, be it in English, French, or any other language, can be assessed by the government to determine the number of individuals who possess fluency in a particular language. This information can then be utilized to provide suitable language instruction and gauge the effectiveness of government initiatives.
* **Community involvement:** Identify the personalities from First Nations, Inuit, and Métis communities who are great leaders, officers, or speakers, so that we can provide them as examples to motivate individuals towards education and as an explanation of community involvement.
* **Age:** Age can be used by the government to compare educational data across different age categories, both in the past and after implementing strategies, to predict future growth.
* **Gender:** We can compare the percentage of men and women pursuing education and can put efforts to increase their percentage.
* **Type of Educational Institute:**We can track the data of the Federal government and Provincial government schemes available to help Indigenous people of Canada and use that data to launch new schemes and program.
* **Level of Education:** It can be used to determine the current level of education of Indigenous individuals, whether it is at the school, high school, bachelor's, master's, or doctoral level, and whether they are currently working.
* **Government Funding:** Government funding allows Indigenous people to access and track the financial support provided by the government for their educational welfare.
* **Employment Sector:** It can be used to determine the percentage of Indigenous individuals working in the government, private, or other sectors in Canada.

**Longitudinal Tracking:**By using our data, Government can identify the problems indigenous community is facing, plan for the strategies to help them and can see how much effective their solution is by collecting and processing the data gain.

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