INTERNATIONAL STUDENT MOBILITY NETWORK

ES 404 NETWORK SCIENCE | PROF. UDIT BHATIA

AUTHORS

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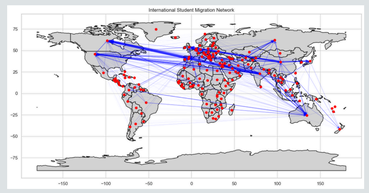
INTRODUCTION

- International student mobility has seen considerable shifts in recent years, shaped by changing education policies, geopolitical developments, and global economic trends.
- Understanding how students move across borders for higher education provides valuable insights into international academic influence.
- This project aims to analyze the structural patterns of global student migration through a network-based approach.

The chosen network framework allows for:

- Identifying major study destinations and key source countries.
- Understanding how scholarships, or policy changes affect student flows.
- Exploring how countries are grouped based on student migration patterns and how students move between them in large numbers.

DATASETS



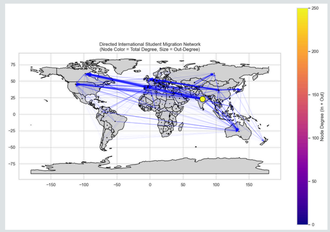
International Student Migration Network

The network is constructed by representing each country as a node, capturing its role as both a sender and receiver of international students. Edges are drawn from source countries to destination countries wherever a significant flow of students exists. The weight of each edge reflects the number of students migrating along that route, indicating the strength of the connection. This results in a directed, weighted network that not only shows which countries are connected but also reveals the intensity of student movement between them.

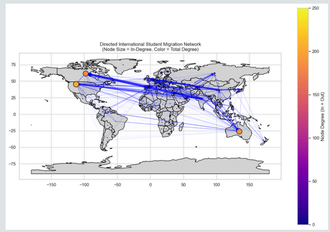
RESEARCH QUESTIONS

- Which countries act as central hubs in the global student mobility network?
- What are the most prominent source and destination countries for international students, and what factors contribute to these patterns?
- How do global events influence the structure and flow of the student mobility network?
- How do scholarship programs impact student migration patterns across regions?
- Can we identify clusters or communities of countries that exchange students more frequently among themselves? What regional or linguistic patterns emerge?
- What role do economic indicators (GDP, tuition cost, employment opportunities) play in shaping student migration networks?
- How does the directionality and intensity of student flows evolve between developed and developing countries over time?

NETWORK CONSTRUCTION



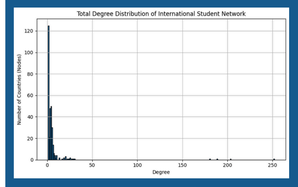
International Student Migration Network (node size based on out-degree)



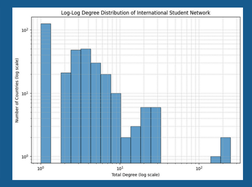
International Student Migration Network (node size based on in-degree)

KEY PROPERTIES

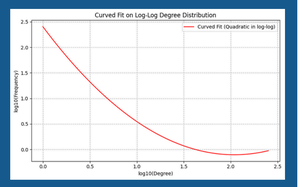
Objective: To analyze the structural properties of the global student migration network by examining degree distributions, centrality metrics, and connectivity patterns among countries.



Total degree distribution of the network

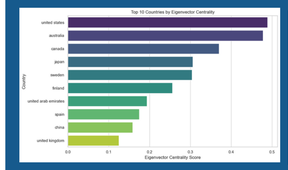


Log-Log degree distribution

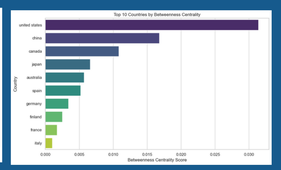


Curevd fit on Log-Log degree distribution

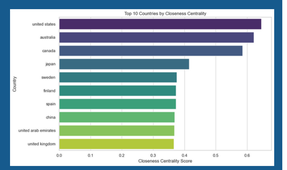
The above plot illustrates the total degree distribution of the international student network, indicating how many countries have a given number of inbound and outbound student exchange links. Applying log-log binning and fitting a curve to the tail of the distribution revealed a power-law behavior, confirming that the network exhibits scale-free properties with a few highly connected hubs and many sparsely connected nodes.



Eigenvector Centrality Scores

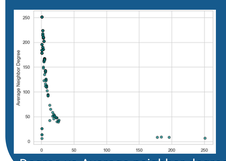


Betweenness Centrality Scores



Closeness Centrality Scores

The **United States, Canada, and Australia** consistently rank high across all centrality metrics, indicating they are the most preferred education destinations globally.
India shows a dominant hub score, suggesting it plays a major role in sending students abroad and linking to various international education systems.
China features strongly in both authority and hub scores, reflecting its dual role as both a leading education destination and a major source of outbound students.



Degree vs Average neighbor degree

The Degree Assortativity Coefficient of -0.6748 suggests that high-degree countries tend to connect with low-degree countries. This reflects a tendency for major student migration hubs to engage with less-connected countries.
As node degree increases, the average degree of its neighbors sharply decreases. High-degree nodes (likely major education destination countries) are connected to low-degree nodes (smaller, less-connected source countries).

INSIGHTS

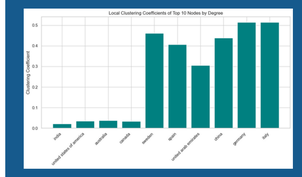
Objective: To uncover global student migration patterns by analyzing country-to-country flows and identifying key clusters and influential hubs.

Student Migration Network colored by community

We built a global student migration network using Louvain community detection to uncover clusters of countries based on student flow patterns. Major communities include South and Southeast Asia (e.g., China, India), Western countries (e.g., USA, UK, Australia), and regional clusters like Middle East, Africa, and Latin America.

Student Migration Network colored by community

Initially, the graph included all countries, leading to many small, fragmented communities. After filtering to retain communities with at least 3 members, we ended up with 6 clearer, more meaningful communities that highlight global migration trends.
Countries with similar educational systems, migration policies, and economic connections tend to cluster together. Additionally, regional proximity and language similarities play a significant role in shaping these patterns. Only certain countries with strong migration flows and shared interests formed distinct, cohesive communities, indicating the influence of geopolitical factors.



Local Clustering Coefficients of Top 10 nodes by degree

- High-degree nodes (India, USA, Australia) act as global bridges, but their neighbors aren't connected → low clustering.
- European countries (Germany, Italy, Sweden, Spain) show high local clustering, typical of regional educational initiatives.
- UAE and China show intermediate behavior—moderate connections, moderate clustering, hinting at regional strength with some global pull.

CONCLUSIONS

1) The **United States, Canada, and Australia** emerge as central hubs, ranking high in all centrality metrics, indicating they are top education destinations. India and China also act as major hubs—**India** primarily as a **sender** and **China** as both a **sender and receiver.**
2) **India** is a dominant **source** country, while the **US, UK, Canada, and Australia** are key **destinations**. Contributing factors include educational quality, language, visa policies, historical ties, and job opportunities.
3) Global events can reshape flows by tightening or relaxing mobility. For example, COVID-19 led to **temporary declines**, while visa policy changes in the US or UK, redirected flows to more open countries like Canada or Germany.
4) Scholarship programs like **Erasmus+**, **Fulbright**, and **DAAD** significantly influence flows by creating dedicated pathways and **funding support**, often fostering stronger intra-regional mobility. These programs increase connectivity, particularly within Europe and between the Global North and South.
5) Community detection reveals clusters based on regional, linguistic, or historical ties—like Francophone Africa with France, or South Asian countries linking to the UK—highlighting how shared culture and proximity drive student exchange.
6) Economic factors such as GDP, tuition costs, and employment opportunities shape both demand and destination choice. Wealthier countries attract more students, while **lower-income nations** tend to send students **abroad** seeking better prospects.

INFERENCES

The network reveals that countries with similar education systems, languages, or close locations often form groups. Major hubs like India, the USA, and Australia connect many countries but don't create tight local clusters. European countries show strong local links, while places like the UAE and China have both regional and global ties. Overall, student migration is shaped by geography, language, and international relationships.

FUTURE WORK

In the future, this study can be improved by looking at how student movement between countries changes over time. We can also add more information, like economic factors or education policies, to better understand why students choose certain countries. Finally, collecting more detailed data, such as students' fields of study or degree levels, would give us a clearer picture of international student mobility.

ACKNOWLEDGEMENTS

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