CO-OPERATIVE EDUCATION ANALYTICS: SATISFACTION & RELATIONSHIPS AMONG PROGRAMS

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Who we are...

- **Professor Lukasz Golab**
  - Assistant Professor in Management Sciences, cross appointed to Computer Science
  - BSc in Computer Science from the University of Toronto (2001)
  - PhD in Computer Science from the University of Waterloo (2006)
  - **Research Interests**: big data; applications of big data on energy and education

- **Yuheng Helen Jiang**
  - BASc. In Management Engineering from the University of Waterloo (2013)
    - Accomplished 6 co-op terms using the Jobmine system
  - (almost) MASc in Management Sciences from the University of Waterloo (2015)
  - **Research Interests**: applications of data mining on energy and education
Agenda

- **Satisfaction**
  - **Objective**: determine the factors affecting student and employer success and satisfaction with the co-op experience

- **Relationships among academic programs**
  - *Master thesis*: On Competition for Undergraduate Co-op Placements: A Graph Mining Approach
  - **Objective**: improve the co-op process by characterizing the relationships and extent of competition for co-op placements among students from various academic programs

- **Future work**
SATISFACTION

Title: Analyzing student and employer satisfaction with cooperative education through multiple data sources
Satisfaction: Data

- 3 years (Winter 2009 – Fall 2011) of
  - employers’ evaluations of students (19 sub-categories 1-4/ not applicable & overall evaluation 1-5)
  - students’ evaluations of employers (overall evaluation 1-10)
- Engineering students only
- Other factors:
  - Work term number
  - Length of co-op terms: 4 months or 8 months
  - Timing of the first work term: after 1 or 2 terms
  - Location: abroad, domestic
  - How to find a co-op job: regular process, self-arranged, return (work term status)
**Satisfaction: Key Finding 1**

- **Overall:** Students are generally willing to learn new skills, but may not have much leadership experience.

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**Figure 2:** Average and standard deviations of the scores of the 19 sub-categories of employers’ evaluations of students.
Satisfaction: Key Finding 2

- **Overtime:** students with more work experience receive higher scores

Figure 3: Percentage of co-op students in each evaluation category from outstanding to unsatisfactory and average of employer’s evaluation over first to sixth work terms
Satisfaction: Key Finding 3

- 50% of evaluations are **not applicable**: conflict management and leadership

- Over 6 terms:
  - integration of prior learning, setting goals, and leadership decreased significantly

- Returning students:
  - conflict management, leadership and integration of prior learning decreased significantly
Keywords in job titles and employer names

First year

Table 2: Top 10 keywords from employer names and job titles for first-year engineering students

<table>
<thead>
<tr>
<th>Employer Name Keywords</th>
<th>Job Title Keywords</th>
</tr>
</thead>
<tbody>
<tr>
<td>University</td>
<td>Engineering</td>
</tr>
<tr>
<td>Ontario</td>
<td>Assistant</td>
</tr>
<tr>
<td>Toronto</td>
<td>Developer</td>
</tr>
<tr>
<td>General</td>
<td>Software</td>
</tr>
<tr>
<td>Research</td>
<td>Junior</td>
</tr>
<tr>
<td>System</td>
<td>Architectural</td>
</tr>
<tr>
<td>Engineering</td>
<td>Web</td>
</tr>
<tr>
<td>Canadian</td>
<td>Technical</td>
</tr>
<tr>
<td>City</td>
<td>Research</td>
</tr>
<tr>
<td>Environment</td>
<td>IT</td>
</tr>
</tbody>
</table>
Satisfaction: Key Finding 5

- **Effect of work term length**
  - Nearly 70% of students stayed 8-month work terms with the same employer.
  - 4-month with two positions:
    - Students were rated higher on their ability to learn, quality of work, quantity of work, creativity, problem solving and reliability.
  - 8-month with one position:
    - Students were rated higher in goal setting, judgment, conflict management, initiative and leadership.
    - N/A% decreased in goal setting and integration of prior learning.
    - Students rated their employer 10% lower.
Satisfaction: Key Finding 6

- **Timing of first work term**
  - Students’ evaluation of employers
    - After 1 term > After 2 terms
  - Employers’ evaluation of students
    - No significant difference
Satisfaction: Key Finding 7

- **International vs. Domestic**
  - 10% positions were outside of North America
  - Keywords in job titles
    - International: trainee, intern
    - Domestic: co-op
  - First term working abroad
    - More self-arranged positions
    - Students were rated worse, and less satisfied
  - Upper years
    - Students were rated better, and more satisfied
Satisfaction: Conclusion

- Students’ perspective
  - Expect N/A ratings in some categories
  - Stay with the same employer?
  - Work abroad?

- Employers’ perspective
  - N/A option exists

- Institutions’ perspective
  - When to start the first work term?
  - International positions?
  - Data collection
RELATIONSHIPS AMONG ACADEMIC PROGRAMS

Title: On Competition for Undergraduate Co-op Placements: A Graph Mining Approach
Relationship: Data Overview

- One term of interview data
  - 16,855 student-job interview pairs
  - 2,890 jobs
  - 4,194 students from 93 academic programs

- Job
  - Job title, advertised programs, advertised seniority

- Student
  - Academic program, academic year
Relationship: Graph Definition
Relationship: Graph Definition (Cont’d)

Figure 4.1: Full program graph
Six degrees of separation

Programs are REALLY connected!
Relationship: Two graphs

- Full program graph vs. Senior program graph

- Finding:
  - Senior students compete for jobs with students from fewer programs (less edges)
  - Relationships that do exist are stronger (thicker edges)
Unclear differences among academic programs
- Similar programs: clusters

Increasing need for multi-disciplinary and well-rounded education [9,10,18,71,119]
- Multi-disciplinary programs: outliers

Example of jobs for promotion
- Competing programs: fan-out metric
Figure 4.17: Hierarchy of partition results of senior program graph
Relationship: Multi-disciplinary programs

- Management Engineering (senior): 5th highest entropy

Figure 4.22 & 4.23: Word cloud for job titles of jobs that interviewed junior/senior Management Engineering students
Relationship: Multi-disciplinary programs

Question: well-rounded students or sets of specialized students?

Figure 4.36: Cumulative percentage of students over number of clusters of direct competitors (7 clusters)
16 programs do not have any jobs that interviewed only their students.

8 programs have more than 30 percent of the jobs only interviewed their students.

Figure 4.24: Level of competition of programs in the senior program graph in descending order.
Similar programs
- Academic programs did not always align well with the groups of closely connected programs
- Clusters can be used to create job categories and academic specializations

Multi-disciplinary programs
- Identification and verification

Competing programs
- Attract more employers that offer jobs to programs that face high competition
Future Work

- Develop recommender systems
  - Recommend jobs to students
  - Recommend students to employers
- Temporal analysis
  - What has changed over the years?
  - How does co-op behavior relate to key events or social factors?
- Ranking
  - How do employers and students play the ranking “game”?
- Collaboration!
THANK YOU!

QUESTIONS?

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