The following presentation was given at the 20th Annual Conference for the National Institute for the Study of Transfer Students. In some cases, photos have been removed to avoid possible copyright infringement.

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Research Spotlight

2339 - Exploring Credit Loss for Engineering Transfer Students
Credits and Degree Pathways, Matriculation Trends and Issues

Credit loss can significantly impact transfer students enrolled in highly sequential degrees, such as engineering. Missing one crucial prerequisite course at the time of transfer can extend a student’s time to degree by a year or more. Determining what credits transfer in engineering could help ease the transfer process, improve graduation rates, and broaden participation in engineering. This session will examine the multiple kinds of credit loss of engineering transfer students.

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Virginia Tech
AMY RICHARDSON

Graduate Student
Virginia Tech Engineering Education Ph.D.
Assistant Professor - Engineering
Northern Virginia Community College

DAVID KNIGHT

Associate Professor & Special Assistant to the Dean for Strategic Planning Virginia Tech
WHY ENGINEERING STUDENTS?

- Broaden participation
- Engineering degrees are highly sequential/specialized
- Engineering degrees have a high curricular complexity scores
CREDIT LOSS
CREDIT LOSS CALCULATIONS

CREDIT TRANSFERABILITY

Credits earned prior to transfer
–
Credits accepted at the time of transfer.

(Miani, M. S., 2019)
(Monaghan & Attewell, 2015)
(Fink et al., 2018)

APPLICABILITY OF TRANSFER CREDIT

Accepted Transfer Credit
–
Credits used to meet a Degree Requirement

(Fink et al., 2018)

EXCESS CREDITS

Total Number of Credits Earned
–
Total Number of Credits Required in the Degree Program

(Fink et al., 2018)
FROM YOUR EXPERIENCE, WHAT ARE SOME REASONS WHY CREDIT LOSS OCCURS?
FROM YOUR EXPERIENCE, WHAT ARE SOME REASONS WHY CREDIT LOSS OCCURS?

- Change of Major
- Transfer receptivity of receiving institution
- Non-Credit or Pre-requisite Courses (Pre-Calculus)
- Maximum Number of Credits Allowed to Transfer
- Lack of Equivalent Courses
97,905 Student Observations

- Reduced observations to students with Engineering major
- Filtered 1st time transfer students
- Students earn a Bachelor’s degree
- Removed double majors
- Identify one transfer institution for each student (assigned the institution with the most credits transferred)

1,289 Student Earned BS Degree Engineer 1st Time Transfer Earned BS Degree
CREDIT LOSS CALCULATION

\[
\text{Transfer Credit} + \text{VT Credit} - \text{Credits in Degree} = \text{Credit Loss}
\]

- All transfer credits accepted by Virginia Tech
- Total number of VT credits
- Total Number of Credits in Degree Earned
- Remove NA and negative values for credit loss
DESCRIPTIVE STATISTICS

n=1289
Mean = 23.44
sd=20.28
Median = 19
Min = 0
Max = 130
Skew = 1.57
Kurtosis = 3.31
Se = 0.56
COLLEGE OF ENGINEERING

- Largest College at VT
- 10,000 UG Students
- 14 Engineering Majors
- 300 transfer/year enrolled
**ENGINEERING DISCIPLINE**

Kruskal-Wallis Test concludes that Engineering Major does significantly relate to credit loss.

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Count</th>
<th>Mean</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil</td>
<td>227</td>
<td>16.778</td>
<td>11</td>
</tr>
<tr>
<td>Mechanical</td>
<td>337</td>
<td>17.877</td>
<td>14</td>
</tr>
<tr>
<td>Computer Science</td>
<td>125</td>
<td>23.316</td>
<td>17</td>
</tr>
<tr>
<td>Electrical</td>
<td>185</td>
<td>22.914</td>
<td>17</td>
</tr>
<tr>
<td>Chemical</td>
<td>66</td>
<td>27.417</td>
<td>22.5</td>
</tr>
<tr>
<td>Computer</td>
<td>91</td>
<td>26.154</td>
<td>23</td>
</tr>
<tr>
<td>Engineering Science &amp; Mechanics</td>
<td>33</td>
<td>27.909</td>
<td>26</td>
</tr>
<tr>
<td>Aerospace</td>
<td>73</td>
<td>35.836</td>
<td>32</td>
</tr>
<tr>
<td>Industrial Systems</td>
<td>73</td>
<td>34.151</td>
<td>33</td>
</tr>
<tr>
<td>Material Science</td>
<td>37</td>
<td>38.703</td>
<td>40</td>
</tr>
</tbody>
</table>

*Removed disciplines with less than 30*
CREDIT LOSS BY TRANSFER TYPE

Transfer Institution
- Determined by the institution that transferred in the most credits

Total Semester Time to Degree
- Determined by the number of semesters enrolled in VT until degree was earned

Data Cleaning
- Removed where transfer institution was NA
- Transient
TRANSFER TYPES

**HORIZONTAL**
Transfer from University to University

**VERTICAL**
Transfer from a Community College to a University

**VERTICAL-VCCS**
Transfer from a Virginia Community College to a University

HORIZONTAL TRANSFER 141 different institutions
VERTICAL TRANSFER

40 different institutions
VERTICAL TRANSFER - VCCS 23 institutions
VERTICAL TRANSFER - VCCS

- Common course numbering, syllabi, and transfer equivalencies
- Guaranteed Admissions Agreement
  - Earn Engineering, AS degree
  - Minimum 3.2 GPA
- General Education Waiver
  - Students that earned AS degree
TRANSFER TYPE DISTRIBUTION

- Horizontal: 61%
- Vertical: 9%
- Vertical-VCCS: 30%

1110 Total Students
Credit Loss by Transfer Type

Credit Loss by Transfer Type

Count

Credit Loss

Horizontal

Vertical-NoVCCS

Vertical-VCCS

CREDIT LOSS BY TRANSFER TYPE
Credit Loss by Transfer Type

- p < 0.001 we reject the null hypothesis and conclude that credit loss differs between transfer types.

<table>
<thead>
<tr>
<th>Transfer Type</th>
<th>Count</th>
<th>Mean</th>
<th>Median</th>
<th>Max</th>
<th>Min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal</td>
<td>329</td>
<td>29.40058</td>
<td>23</td>
<td>130</td>
<td>0</td>
</tr>
<tr>
<td>Vertical-NoVCCS</td>
<td>102</td>
<td>29.57353</td>
<td>25</td>
<td>83</td>
<td>0</td>
</tr>
<tr>
<td>Vertical-VCCS</td>
<td>679</td>
<td>20.49705</td>
<td>16</td>
<td>93</td>
<td>0</td>
</tr>
</tbody>
</table>
Kruskal-Wallis Test concludes that Engineering Major does **NOT** significantly relate to credit loss for horizontal transfer students.

*Removed disciplines with less than 20*

<table>
<thead>
<tr>
<th>Disciplines</th>
<th>Count</th>
<th>Mean</th>
<th>Median</th>
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</thead>
<tbody>
<tr>
<td>Civil</td>
<td>59</td>
<td>30.208</td>
<td>20</td>
</tr>
<tr>
<td>Computer</td>
<td>24</td>
<td>27.458</td>
<td>23.5</td>
</tr>
<tr>
<td>Computer Science</td>
<td>29</td>
<td>28.931</td>
<td>23</td>
</tr>
<tr>
<td>Electrical</td>
<td>50</td>
<td>31.780</td>
<td>24</td>
</tr>
<tr>
<td>Industrial &amp; Systems</td>
<td>25</td>
<td>29.880</td>
<td>27</td>
</tr>
<tr>
<td>Mechanical</td>
<td>92</td>
<td>26.516</td>
<td>20.5</td>
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</table>
Kruskal-Wallis Test concludes that Engineering Major does significantly relate to credit loss for horizontal transfer students.

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Count</th>
<th>Mean</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerospace</td>
<td>16</td>
<td>25.125</td>
<td>22</td>
</tr>
<tr>
<td>Civil</td>
<td>19</td>
<td>17.974</td>
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<tr>
<td>Chemical</td>
<td>13</td>
<td>40.154</td>
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<tr>
<td>Computer</td>
<td>10</td>
<td>41.600</td>
<td>50</td>
</tr>
<tr>
<td>Mechanical</td>
<td>26</td>
<td>18.5</td>
<td>19</td>
</tr>
</tbody>
</table>

*Removed disciplines with less than 10*
Kruskal-Wallis Test concludes that Engineering Major does significantly relates to credit loss for horizontal transfer students.

*Removed disciplines with less than 30*
DIFFERENCES IN DISCIPLINES

- Number of total credits
- Number of key transferrable courses
- Curricular Complexity

Figures from:
https://doi.org/10.1080/10668926.2020.1798303
CLOSER LOOK AT VCCS
### Closer Look at VCCS Transfer

Only include schools with \( n > 30 \)

- Central Virginia
- J Sargeant Reynolds
- New River
- Northern Virginia
- Tidewater
- Virginia Western

<table>
<thead>
<tr>
<th>TransInst.Name</th>
<th>n</th>
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<tbody>
<tr>
<td>Blue Ridge ege VA</td>
<td>17</td>
</tr>
<tr>
<td>Central Virginia</td>
<td>35</td>
</tr>
<tr>
<td>Dabney Lancaster ege</td>
<td>1</td>
</tr>
<tr>
<td>Danville</td>
<td>11</td>
</tr>
<tr>
<td>Eastern Shore</td>
<td>3</td>
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<tr>
<td>Germanna</td>
<td>25</td>
</tr>
<tr>
<td>J Sargeant Reynolds</td>
<td>31</td>
</tr>
<tr>
<td>John Tyler</td>
<td>6</td>
</tr>
<tr>
<td>Lord Fairfax</td>
<td>18</td>
</tr>
<tr>
<td>Mountain Empire ege</td>
<td>1</td>
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<tr>
<td>New River</td>
<td>51</td>
</tr>
<tr>
<td>Northern Va</td>
<td>275</td>
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<tr>
<td>Northern Virginia Comm Coll</td>
<td>1</td>
</tr>
<tr>
<td>Patrick Henry</td>
<td>4</td>
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<tr>
<td>Piedmont Virginia ege</td>
<td>23</td>
</tr>
<tr>
<td>Rappahannock</td>
<td>2</td>
</tr>
<tr>
<td>Southside VA Alberta</td>
<td>1</td>
</tr>
<tr>
<td>Southwest Virginia</td>
<td>18</td>
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<tr>
<td>Thomas Nelson</td>
<td>21</td>
</tr>
<tr>
<td>Tidewater</td>
<td>47</td>
</tr>
<tr>
<td>Virginia Highlands</td>
<td>8</td>
</tr>
<tr>
<td>Virginia Western</td>
<td>75</td>
</tr>
<tr>
<td>Wytheville</td>
<td>5</td>
</tr>
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</table>
CREDIT LOSS BY VCCS INSTITUTION

- p < 0.001 we reject the null hypothesis and conclude that credit loss differ between VCCS.
- Pairwise comparisons using Wilcoxon rank sum test with continuity correction

<table>
<thead>
<tr>
<th>VCCS</th>
<th>Count</th>
<th>Mean</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Va</td>
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<td>21.57143</td>
<td>17</td>
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<tr>
<td>J Sargeant Reynolds</td>
<td>31</td>
<td>17.09677</td>
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<tr>
<td>New River</td>
<td>51</td>
<td>23.15683</td>
<td>16</td>
</tr>
<tr>
<td>Norther Va</td>
<td>275</td>
<td>21.75091</td>
<td>18</td>
</tr>
<tr>
<td>Tidewater</td>
<td>47</td>
<td>21.80851</td>
<td>22</td>
</tr>
<tr>
<td>Va Western</td>
<td>75</td>
<td>13.12</td>
<td>8</td>
</tr>
</tbody>
</table>
PERCENTAGE OF TRANSFERS BY DISCIPLINE

Northern VA
Virginia Western
FINDINGS

CREDIT LOSS DIFFERS BETWEEN

- Engineering disciplines
- Transfer types
- VCCS institutions
IMPLICATIONS

TIME TO DEGREE
Critical courses

MATRICULATION RATES
Ideal time to transfer

ADVISING
Targeted by discipline

MOTIVATION
Non-transferable course
WHAT ARE SOME USEFUL WAYS WHERE DISAGGREGATING DATA MIGHT SHOW A MORE NUANCED STORY?
FUTURE WORK

• Transcript level data
• Disaggregate by institutional factors
EXPLORING CREDIT LOSS FOR ENGINEERING TRANSFER STUDENTS

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