RevUp: Empowering Montana's Workforce

Student Impact Analysis Study Report

Great Falls College Montana State University

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Introduction

In 2013, a consortium of 13 Montana two-year colleges initiated the RevUp program with funding provided by the U.S. Department of Labor (DOL) through the Trade Adjustment Assistance Community College and Career Training (TAACCCT) Round 3 grant program. RevUp provides short-term credential programs in advanced manufacturing, energy, and related fields—as well as support services for students in those programs—and seeks to align those programs with Montana's workforce system and labor force needs.

The RevUp consortium engaged RTI International to evaluate and collect data on the development of online training, the redesign of manufacturing and energy programs, new student services implemented under the grant, and connections with apprenticeship and sector strategy initiatives. The first of the evaluation's four final reports focused on the implementation of RevUp strategies and initiatives. The other three analyses are:

- A return on investment analysis of the effects of credential attainment in Montana's 2-year colleges on labor market outcomes;
- A quasi-experimental impact analysis to compare educational outcomes of students in advanced manufacturing programs before and after RevUp implementation; and
- A quasi-experimental analysis of developmental math outcomes for students who enrolled in developmental math courses at the University of Montana – Missoula and Missoula College before and after implementation of an emporium math program.

This report summarizes the second analysis listed above, presenting the results of a quasi-experimental analysis of the effects of the RevUp advanced manufacturing programs on student outcomes using propensity score matching. The impact analysis focuses on RevUp's advanced manufacturing programs, which include welding, machining, and fabrication, for two reasons. First, advanced manufacturing is the largest RevUp program, with data for ten of the colleges offering the program are included in this study.[1] Second, other RevUp programs, such as the commercial driver's license training were offered as noncredit certificate programs, for which data are not collected by Montana's postsecondary statewide data system.

[1] All colleges but Miles and Little Big Horn enrolled students in advanced manufacturing programs during the study period, but data on students and student outcome are not available from Fort Peck Community College. Because of the way data for Bitterroot and

The findings included in this report do not, however, provide evidence regarding the effectiveness of RevUp in preparing students for employment because of data limitations. For community college programs of a year or more, one year of data is not generally not regarded as enough time for students to complete their programs and find employment. Time to degree may be even longer for students attending workforce preparation programs who may be working while enrolled or have families, necessitating part-time attendance or taking semesters off. This aim of this analysis is to provide a model for the RevUp colleges or OCHE to use to conduct a future analysis of RevUp advanced manufacturing student outcomes once two or more years of data on RevUp students are available. RTI is working with Great Falls College, Montana State University to access additional data. If the Montana Office of the Commissioner of Higher Education and Missoula College are able to provide the data needed for the impact analysis, including additional years of data and data on students' labor market outcomes, RTI will submit an update of this report by the end of the 2017 calendar year.

Researchers from RTI International ("the evaluation team") assessed the impact of the advanced RevUp manufacturing program on (1) student degree/certificate completion within a year of enrollment in the first RevUp course, (2) program enrollment, (3) grade point averages (GPA), and (4) cumulative credits over the year. The Montana Office of the Commissioner of Higher Education (OCHE) provided data on students enrolled in RevUp courses from spring term 2013 through the end of fall term 2016. The evaluation team selected fall 2014 as the date of the full implementation of the RevUp program in accordance with the DOL's timeframe for TAACCCT grant program development and implementation. The impact analysis compared the outcomes of students who enrolled in advanced manufacturing programs before ("the comparison group") and after ("RevUp students") fall 2014. The analysis employed a propensity-score based weighting strategy to ensure that the demographic and enrollment characteristics of the comparison group resembled those of the RevUp students, and to control for factors that may influence student outcomes apart from RevUp implementation. The analysis seeks to answer the following two sets of research questions:

- Degree/Certificate Completion: Were RevUp students more likely than comparison group students to complete a degree or certificate within the first year of the program? Were they less likely to drop out of the program within the year?

- Grade Point Average (GPA) and Credit Accumulation: Did RevUp students have higher GPAs than comparison group students by the end of the first year? Did they accumulate more credits (total course credits or RevUP course credits)?

Because of data limitations, this study should be regarded as exploratory, particularly for the analysis of credential attainment. One year is not enough for students to complete a program

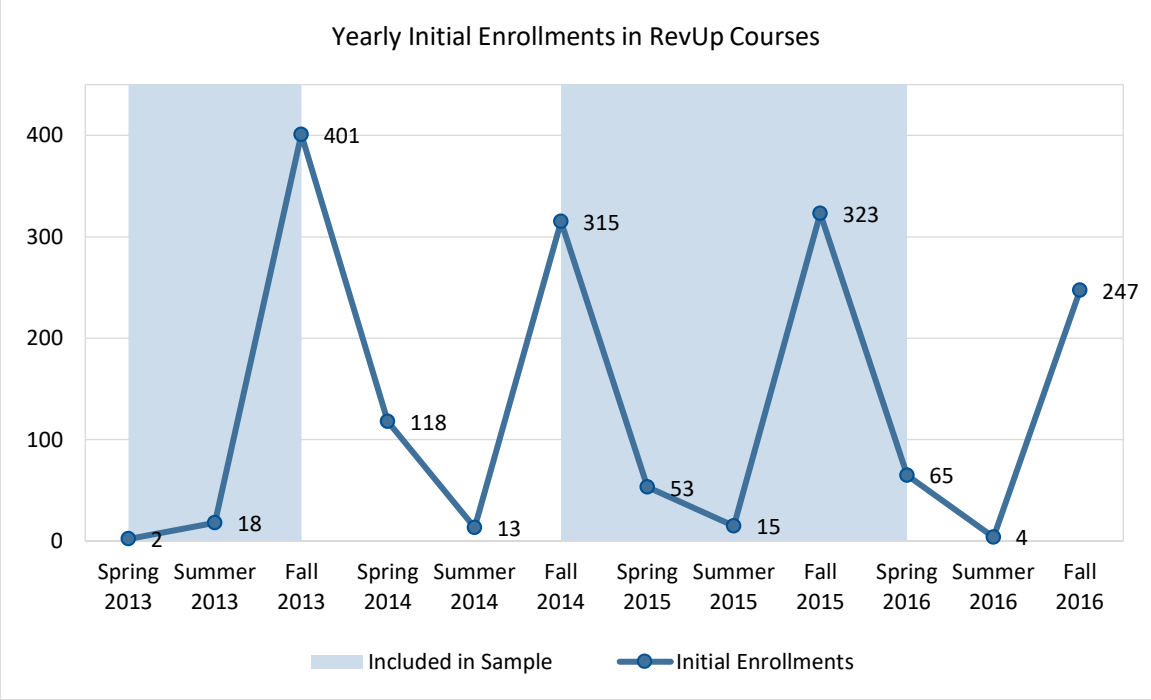
and find employment, particularly since students' average age in the program was about 25 and many likely have work and family responsibilities. Over ten percent attended part-time, and some may also have breaks in enrollment. Accordingly, the study is not intended to provide conclusions about the impact of RevUp on student outcomes, but instead put forth an analytical model that the colleges and OCHE might use to assess the program's effects in the future. The analysis would require data on advance manufacturing students who first enrolled in their programs in spring 2010 through spring 2017 to include at two cohorts of students with at least two years of post-program enrollment data before and after RevUp implementation.

Data

The student-level data available for this study include 1,574 students who attempted 9 or more credit hours in the advanced manufacturing programs included in RevUp from spring term 2013 through fall term 2016 (Exhibit 1). Because the data for the analysis include only three years (spring 2013-fall 2016) and RevUp programs were not considered implemented until fall 2014, the analysis examined student outcomes within one year following their entry in the program in order to have a sample size adequate for analysis.

Students who were enrolled during the spring or summer of 2014 (n = 131) were excluded from the sample to avoid treatment crossover, as were those first enrolled in summer or fall of 2016 (n = 251), in this case to ensure at least a one-year observation window for all students in the sample. The final analytic sample includes 1,192 students. Approximately 35 percent of the sample took their initial RevUp courses prior to full RevUp implementation $(n = 421)$ while 65 percent of them took advanced manufacturing courses after the RevUp implementation $(n = 771)$.

Exhibit 1. Number of students enrolled in advanced manufacturing courses in RevUp colleges by term, spring 2013 to fall 2016



Students in the analytic sample were predominantly white (82 percent) and male (93 percent)[2]. American Indian or Alaska Native students accounted for 8 percent of the sample. On average, advanced manufacturing students were approximately 25 years old at their most recent term of enrollment. Their average high school grade point average (GPA) was 2.8. However, 42 percent of the students did not have high school GPA on record. Because ACT scores were available for less than half of the students (37 percent), ACT scores are not used in the analysis, but the availability of an ACT score was included in the analysis as a proxy measure for prior academic achievement. About 28 percent of the sampled students took math or English remediation courses, and 43 percent received Pell grants and 8 percent, veteran's education benefits during their first year of program enrollment. Six percent students were identified as having a disability. Most students (88 percent) were enrolled full time throughout the first year.

Pairwise comparisons suggest that RevUp students and comparison group shared some similar demographic and enrollment characteristics. However, compared to their historic cohort, RevUp students were less likely to be male students (coefficient=-.64, SE=.27, $\chi^2=5.60$, $p<.05$) and were more likely to receive veteran's education benefits

[2] Based on the University of Montana's racial/ethnic classification system.

(coefficient=.48, SE=.24, χ^2=4.09, p<.05). Fewer RevUp students than earlier students were enrolled in either math or English remediation courses (coefficient=-.26, SE=.13, χ^2=3.86, p<.05). During the first program year, RevUp students were less likely to remain full time (coefficient=-.47, SE=.20, χ^2=5.64, p<.05), but more likely to study on part-time basis (coefficient=.1.07, SE=.37, χ^2=8.32, p<.01).

Exhibit 2. Enrollment and demographic characteristics of students in the RevUp impact analysis analytical sample

	All Students (*n*=1,192)	RevUp Students (*n=771*)	Comparison Group (*n=421*)
Demographic Characteristics			
Race/Ethnicity			
American Indian/Alaska Native	7.7%	7.4%	8.3%
White	81.6%	82.0%	81.0%
No Response	5.9%	5.8%	5.9%
Other	4.8%	4.8%	4.8%
Male	93.1%	91.8%	95.5%
Average Age During Most Recent Term (*sd*)	25.2 (8.2)	25.3 (8.7)	25.0 (7.4)
Enrollment/Academic Characteristics			
High School GPA	2.8 (0.6)	2.8 (0.6)	2.7 (0.6)
High School GPA Not Available	41.7%	42.4%	40.4%
ACT Score Available	36.7%	38.3%	33.7%
Veteran Status	8.4%	9.6%	6.2%
Students with Disabilities	6.2%	6.9%	5.0%
Enrolled in Math or English Remediation	28.4%	26.5%	31.8%
Received Pell Grant	42.5%	41.1%	45.1%
First Year Enrollment Intensity			
Always Full Time	87.9%	86.3%	91.0%
Always Part Time	4.6%	6.0%	2.1%
Mostly Full Time	7.1%	7.4%	6.7%
Mostly Part Time	0.3%	0.4%	0.2%

SOURCE: Montana Office of the Commissioner of Higher Education, September 2017

With regards to the distribution of degree and certificate completion and GPA or course credit attainment within a year of enrolling in a RevUp course, 20 percent of the students in the sample completed a degree or certificate and 7 percent dropped out with no credential (Exhibit 3). Nearly three quarters of students (73 percent) were still enrolled at the end of their first year. Without removing the potential impact of confounding factors, RevUp and comparison group students had similar degree completion rates and cumulative GPAs, but

RevUp students had a higher dropout rate and lower cumulative credits by the end of the first program year.

Exhibit 3. Credential completion and GPA/credit attainment among students in the RevUp impact analysis analytical sample

	All Students	RevUp Students	Comparison Group
Degree Completion in the First Year			
Degree/Certificate Completed	20.1%	20.4%	19.5%
Transferred	0.3%	0.3%	0.2%
Degree/Certificate Not Completed; Still Enrolled	72.7%	71.3%	75.3%
Degree/Certificate Not Completed; Dropped Out	7.0%	8.0%	5.0%
GPA/Credit Attainment			
Average GPA	3.0 (0.9)	3.0 (1.0)	3.0 (0.9)
Cumulative Credits	26.0 (11.7)	24.6 (12.8)	28.5 (8.6)
Cumulative RevUp Credits	20.7 (8.6)	20.8 (8.7)	20.6 (8.6)

SOURCE: Montana Office of the Commissioner of Higher Education, September 2017

Methods

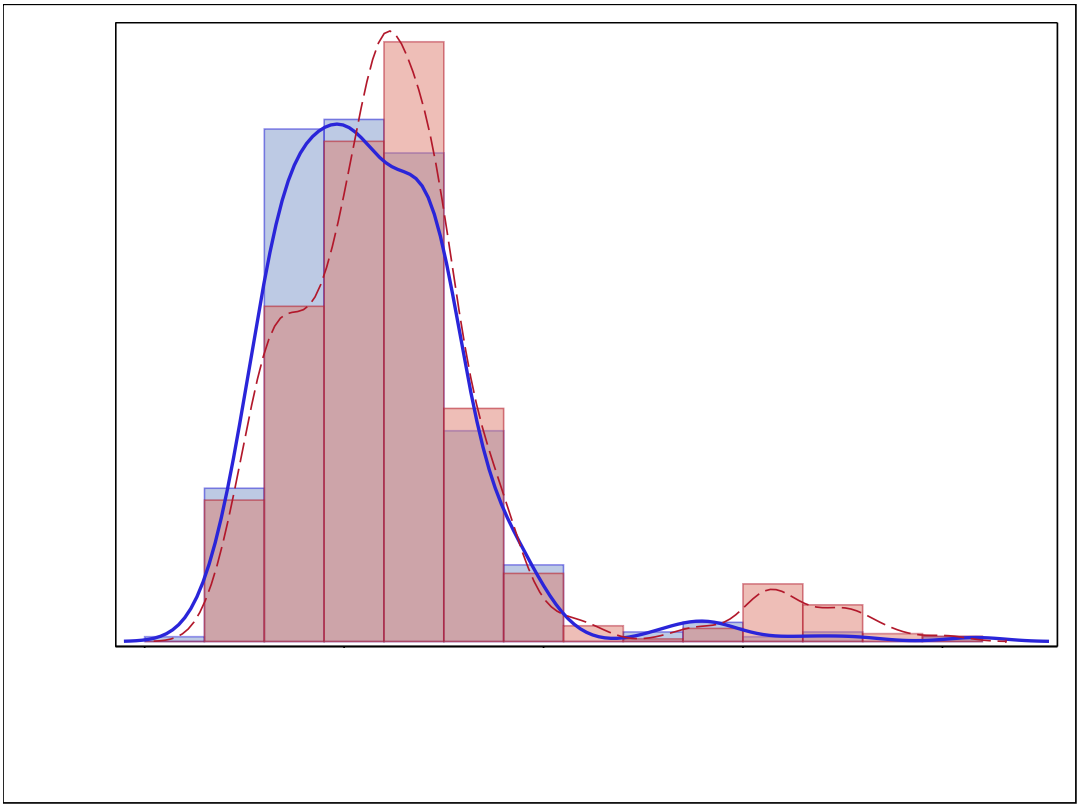
The analysis used the marginal mean weighting through stratification (MMW-S) method, a propensity score-based weighting method to estimate the causal effects of RevUp implementation on advanced manufacturing student outcomes and to remove potential differences in the demographic and enrollment characteristics of students enrolled in RevUp classes. The MMW-S method is a viable solution for evaluating various types of treatments (Hong and Hong 2009). In the analysis of a binary treatment such as participation in a RevUp advanced manufacturing program, MMW-S functions the same as propensity score (PS) stratification; both methods keep all the observations that have a non-zero probability of assignment to one condition (e.g. participation prior to RevUp) versus the other (e.g., participation during RevUp) and that have a match in the alternative treatment condition. MMW-S, however, avoids the risk of a significantly reduced group size that PS matching carries because MMW-S opts uses a nonparametric procedure. Compared to parametric PS weighting procedure such as probability of treatment weighting, it is more robust to potential misspecifications of the functional form of a propensity model (Hong 2010).

The analysis starts with a stepwise logistic regression to identify demographic and enrollment variables that are predictive of the study outcomes. This step revealed ten significant outcome predictors, including high school GPA, missing indicator of high school GPA,

disability status, Pell Grant recipient, always full-time status, always part-time status, availability of ACT score, White, no response on Race/Ethnicity, and age during the most recent term. The next step in the analysis is the calculation of a unidimensional propensity score summarizing these variables, which is used to stratify the sample into five strata based on the distribution of the logit of the propensity score (see Exhibit 4). The final step is the computation of a marginal mean weight as the ratio of the number of students in a stratum to the number of treated students in that stratum. Before adjustment by the marginal mean weight, the RevUp and comparison groups have a group difference of .08 (SE=.02, t=4.30, $p<.0001$) in the logit of the propensity score. After weighting, the group difference becomes insignificant (Difference=.01, SE=.02, t=.35, $p>.5$), which suggests the MMW-S strategy has successfully made the treatment and control groups comparable in observed pretreatment composition; hence any observed differences in outcomes may be attributed to the changes in advanced manufacturing program.

To control for differences in student characteristics between the RevUp and comparison groups, each of the final outcome models include the marginal mean weight. To examine each of the binary outcomes, i.e. outcomes related to degree/certificate completion, a weighted binary logistic regression model is run with group membership (RevUp vs. comparison) as a predictor and the weight is assigned to students in the analytic sample. The analysis includes a weighted regression analysis to examine GPA and credit attainment.

Exhibit 4: Distribution and stratification of the logit of propensity score



Source: Montana Office of the Commissioner of Higher Education, September 2017
Note: The stratification further excludes one students that have either a zero probability of assigning to one or the other treatment condition or had no match in the other condition.

Results

The analysis indicated that RevUp and comparison students had the same likelihood of completing a degree or certificate (Exhibit 5). RevUp students were less likely than comparison group students to remain enrolled in the program by the end of their first program year (coefficient=-.28, SE=.14, χ^2=3.86, p<.05), and more likely to drop out without completing a degree or certificate (coefficient=.56, SE=.26, χ^2=4.54, p<.05). Compared to the historic cohorts, RevUp students had lower GPAs (coefficient=-.22, SE=.06, *t* =-3.74, p<.001) and accumulated fewer course credits (coefficient=-2.77, SE=.61, *t*=-4.55, p<.0001) throughout the year; but earned more RevUp course credits (coefficient=1.01, SE=.47, *t*=2.13, p<.05).

Exhibit 5. Weighted outcome analysis results

	Intercept	Estimated Program Effect	
	Coefficient (SE)	Coefficient (SE)	*t* or *Chisq*
Degree/Certificate Completion			
Degree/Certificate Completed	-1.64 (.14)	.12 (.16)	.45
Degree/Certificate Not Completed; Still Enrolled	1.25 (.12)	-.28 (.14)	3.86*
Degree/Certificate Not Completed; Dropped Out	-3.02 (.23)	.56 (.26)	4.54*
GPA/Credit Attainment			
Average GPA	2.99 (.05)	-.22 (.06)	-3.74***
Cumulative Credits	27.83 (.49)	-2.77 (.61)	-4.55****
Cumulative RevUp Credits	20.03 (.38)	1.01 (.47)	2.13*

Source: Montana Office of the Commissioner of Higher Education, September 2017
Coefficient (Standard Error) is presented.
*p<.05, ** p<.001, *** *p*<.0001

Limitations

As is the case with all studies of this type, the results should be considered in light of a number of limitations, some of which may be addressed once additional data are available should the University of Montana be interested in expanding this analysis.

1. Program implementation time frame: The evaluation team selected fall 2014 as the implementation date in accordance with the U.S. Department of Labor's time frame for TAACCCT grant program development and implementation. In practice and as shown in the implementation study, implementation progress varied by college. Since program implementation is a process that is refined over time, an ideal approach is to test the robustness of the results using different implementation cutoff dates. The National Center for Academic Transformation, for example, recommends a development and implementation time frame of about 18 months (The National Center for Academic Transformation 2013) for emporium-model education programs. The data available at the time of this study did not permit this analysis, but RTI recommends this approach for future analyses.

2. Limited observation time of program effects and smaller number of RevUp students. Since the last term included in this analysis was spring 2016, to ensure comparability of the outcomes between RevUP and the comparison group, this study limited the

observation time to the first year of program enrollment, which is not long enough for students to complete the program.

3. Contextual factors associated with the pre-post program comparison. The analysis is limited by the data available, which allows for a comparison between cohorts that enrolled in advanced manufacturing programs before and after the full implementation date. The estimated effects may be confounded by other environmental effects that occurred over the study years that are not reflected in the data, such as changes in college policies or in employment and college-going rates.

4. Potentially insufficient control for group differences. The propensity score analysis adjusts for the preprogram differences based on the limited number of demographic and academic variables available in the data set. The analysis may not fully capture the pre-program differences between RevUp and comparison group students, such as measures of academic ability.

5. Oversimplified picture of student degree completion status. Due to limitations on the reporting period, the analysis limits the degree completion time frame to one year while students need two years on average to complete a program. In addition, the analysis cannot distinguish between students who stop out or entirely drop out of the program if only one year of data.

6. Missing data and measurement errors in administrative record. Like any other work with school administrative data, the analysis is subject to measurement errors. For example, less than one third of students were found to have taken remedial courses, which suggests potential errors in the data. Also, there are missing values in students' high school GPA. The evaluation team used multiple imputation to impute the missing data and incorporated missing indicators to account for potential missing pattern.

Summary

The quantitative outcomes analysis indicates that RevUp students were as likely as advanced manufacturing students who enrolled in the program prior to RevUp to complete a credential within one year of enrolling. The results also suggest that were less likely to persist for one year and more likely to drop out without completing a degree or certificate by the end of the first program year. RevUp students also had lower GPAs and accumulated fewer course credits than pre-RevUp advanced manufacturing students. As noted in prior sections, however, this study is based on too short a time frame to accurately assess the effect of RevUp on student outcomes.

Future analyses using a longer time frame would be able to include data on more students, to analyze how the programmatic changes brought to Montana's advanced manufacturing programs in two-year colleges have impacted students. In addition, RTI recommends (in accordance with the study limitation described above) that the analysis test different implementation dates, perhaps determined in consultation with the college's RevUp staff. Faculty members may be able to provide feedback regarding when they considered the new courses to be fully implemented, and whether the implementation date should be allowed to vary by college, an option that was not feasible in the current analysis. Finally, as more data become available, analysts may also be able to determine whether individual colleges are driving program effects.

References

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