

# GREATER MEMPHIS ALLIANCE FOR A COMPETITIVE WORKFORCE

## TAACCCT Round 4 Grant

### Final Impact Evaluation Plan

**MARCH 2016**



---

3001 Lake Austin Blvd., Suite 3.200  
Austin, TX 78703 (512) 471-7891  
[raymarshallcenter.org](http://raymarshallcenter.org)

This report was prepared with funds provided by the Corporation for a Skilled Workforce from the U.S. Department of Labor to the Ray Marshall Center for the Study of Human Resources at the University of Texas at Austin. The views expressed here are those of the authors and do not represent the positions of the funding agencies or The University.

## TABLE OF CONTENTS

Background .....	1
Impact evaluation .....	2
Outcomes analysis .....	2
Impact analysis.....	3
Data collection .....	4
Data sources.....	4
Demographic data.....	4
Academic data.....	4
Employment data.....	4
Data collection methods .....	5
Data availability.....	5
Data collection timeline .....	5
Impact analysis design .....	7
Proposed design.....	7
Final design .....	8
Propensity score matching.....	8
Treatment and comparison group assignment .....	10
Group assignment by college.....	10
ASU-Mid South.....	10
Southwest .....	11
Moore Tech.....	12
TCAT-Memphis.....	12
Estimation Methods.....	14
Sample Size & Power Analysis .....	15
Threats to validity .....	17

## LIST OF TABLES

Table 1. Grant-funded programs of study .....	1
Table 2. Data collection timeline for academic data from colleges.....	6
Table 3. Cohort groups for the DID impact analysis design .....	7
Table 4. Cohort groups for the retrospective impact analysis design .....	8
Table 5. Treatment and comparison groups for ASU-Mid South .....	11
Table 6. Treatment and comparison groups for Southwest .....	12
Table 7. Treatment and comparison groups for Moore Tech.....	12
Table 8. Treatment and comparison groups for TCAT-Memphis .....	13
Table 9. Minimum detectable effect, by type of outcome .....	16

## LIST OF APPENDICES

Appendix A. Intake Form .....	18
Appendix B. Data requested for impact evaluation.....	20

## BACKGROUND

The Greater Memphis Alliance for a Competitive Workforce (GMACW), led by Arkansas State University – Mid South, was awarded \$9,814,818 in the fourth round of the Trade Adjustment Assistance Community College Career Training (TAACCCT) grants on October 1, 2014. The GMACW TAACCCT grant represents a consortium of four colleges including Arkansas State University – Mid South (ASU Mid-South) as the lead college, Southwest Tennessee Community College (Southwest), William R. Moore College of Technology (Moore Tech), and Tennessee College of Applied Technology (TCAT). The GMACW TAACCCT grant is focused on creating or enhancing programs for the manufacturing, transportation, distribution and logistics industries in the Memphis area. The grant-supported programs of study at each college are listed in Table 1.

Table 1. Grant-funded programs of study

Manufacturing	
Machining	ASU Mid-South/Moore Tech/TCAT/Southwest (non-credit)
Welding	ASU Mid-South/Moore Tech/TCAT/Southwest (non-credit)
Process Control	ASU Mid-South
Mechatronics	ASU Mid-South
Transportation/Distribution/Logistics	
Diesel	ASU Mid-South/TCAT
Aircraft Maintenance	ASU Mid-South/TCAT
Truck Driving	TCAT

The consortium hired Corporation for a Skilled Workforce (CSW) and the Ray Marshall Center (RMC) of The University of Texas at Austin as the third party evaluation team for this TAACCCT-funded effort. CSW and RMC are providing comprehensive evaluation services in support of GMACW’s TAACCCT grant program. These services include collecting, analyzing, and interpreting data that meet USDOL reporting requirements, inform continuous program improvements and determine the extent to which the various interventions are associated with positive outcomes and impacts. The evaluation consists of two components: (1) an implementation (formative) evaluation, conducted by CSW; and (2) an impact (summative) evaluation, conducted by RMC.

## IMPACT EVALUATION

The impact evaluation conducted by RMC includes three components: a descriptive analysis, outcomes analysis, and an impact analysis. Research questions guiding the impact evaluation include:

- Do participants persist in the program at higher rates than similar non-participants, measured in terms of continued enrollment rates and credit hours completed?
- Do participants complete the program at higher rates than similar non-participants, measured in terms of certificates and degrees attained?
- How do participants' employment rates compare to the employment rates of similar non-participants, measured at program completion and up to four quarters post-completion?
- How do participants' quarterly earnings compare to similar non-participants' earnings post-program completion, measured up to four quarters post completion?
- Do participants experience greater employment stability compared to similar non-participants, as measured by monetary eligibility for Unemployment Insurance (UI) benefits?

### Outcomes analysis

GMACW is expected to lead to a number of significant and measurable outcomes. RMC will document and analyze the outcomes by assembling data on education and employment outcomes over the evaluation period. In alignment with program outcomes reported to DOL, RMC is monitoring, examining and will report the following outcomes:

- Number of GMACW TAACCCT program participants served
- Number of GMACW TAACCCT program participants completing program of study
- Number of GMACW TAACCCT program participants retained in program of study
- Number of GMACW TAACCCT program participants completing credit hours
- Number of GMACW TAACCCT program participants earning credentials
- Number of GMACW TAACCCT program participants enrolled in further education
- Number of GMACW TAACCCT program participants employed after program completion
- Number of GMACW TAACCCT program participants retained in employment after completion
- Number of GMACW TAACCCT program participants received wage increase post-enrollment

## Impact analysis

The impact analysis is designed to address the question: what impact did GMACW's TAACCCT program have on student education and employment outcomes? The main goal of the impact analysis is attribution – isolating the effect of GMACW's TAACCCT program from other factors and potential selection bias.

The main challenge of any impact analysis is to determine what would have happened to program participants if the program had not existed (i.e. the counterfactual). While a program's impact can truly be assessed only by comparing the actual and counterfactual outcomes, the counterfactual is not observed. Without information on the counterfactual, the next best alternative is to compare outcomes of program participants with those of a comparison group of non-participants. Successful impact analyses hinge on finding a good comparison group.<sup>1</sup>

RMC is using a quasi-experimental evaluation methodology to estimate the impacts of the GMACW TAACCCT program on key education and employment outcomes. A quasi-experimental design is appropriate since the program does not easily lend itself to a random assignment evaluation. GMACW consortium colleges are open-access community colleges with limited resources to serve students in targeted programs; randomly assigning these students to different systems of programs and services is resource intensive and would jeopardize the successful implementation of the programs. Recent research has demonstrated that, when carried out under the right conditions, quasi-experimental estimation produces impact estimates that are similar in direction and magnitude to those resulting from more expensive and intrusive experimental (random assignment) evaluation methods.<sup>2</sup>

---

<sup>1</sup> Khandker, S. R., Koolwal, G. B., & Samad, H. A. (2010). *Handbook on Impact Evaluation: Quantitative Methods and Practices*. Washington, DC: World Bank. <https://openknowledge.worldbank.org/handle/10986/2693>

<sup>2</sup> D. Greenberg, D., Michalopoulos, C., & Robins, P. (2006). Do Experimental and Nonexperimental Evaluations Give Different Answers about the Effectiveness of Government-funded Training Programs? *Journal of Policy Analysis and Management*, 25(3).

## DATA COLLECTION

The motivating hypothesis for the impact evaluation is that participation in the GMACW TAACCCT program will produce greater labor market outcomes for participants than for statistically similar non-participants. Underlying this hypothesis is the assumption that an approach incorporating career pathways, prior-learning assessment, and work-informed curricula will produce better outcomes than education and training programs that do not involve this set of factors. Given these assumptions, RMC will estimate the effect of the GMACW TAACCCT program on the following (preliminary list of) education outcomes: credit attainment, program completion, time to completion, and credential attainment. In addition, RMC will also track employment outcomes: placement rates, employment retention rates at three and six months post-placement, and wage gains.

### Data sources

#### *Demographic data*

RMC is obtaining participant demographic and background characteristics collected through intake forms. Intake forms are administered to all TAACCCT grant participants and collect a wealth of information (see Appendix A).

#### *Academic data*

RMC is obtaining individual-level academic progress and educational outcomes from the institutional research data systems at the individual colleges in the Consortium. These databases include information on student demographics, enrollment status, course performance, credit attainment, and program completion. RMC is obtaining this data for GMACW TAACCCT program participants, as well as non-participants in the comparison pool.

#### *Employment data*

RMC will obtain matched individual-level employment outcome data from the Unemployment Insurance (UI) quarterly earnings records, available through each state's employment data system. These records provide individual-level data on earnings, employers of record, and new-hire dates. This data will help RMC track job placement, job retention, and earnings gains. RMC will obtain this data for GMACW TAACCCT program participants, as well as non-participants in the comparison pool.

## Data collection methods

RMC is working with the consortium to develop tools and protocols for collecting, matching, and aggregating the data described above. RMC is also working with the consortium to establish formalized data collection activities and review these activities periodically as a part of implementing good practice. RMC is also providing necessary support to the consortium to ensure compliance with the data collection protocols. All data is being collected at the individual student level for both participants and non-participants in the comparison pool; RMC is developing tools and protocols to match and aggregate this student-level data.

RMC has already entered into data sharing agreements with the four colleges in the consortium in order to access data from their institutional research data systems. RMC is currently working with the consortium to set up data sharing agreements with state workforce agencies in order to access UI data.

### *Data availability*

RMC has reviewed the data elements available in the institutional data systems and the state wage data systems to identify the specific list of variables needed for the evaluation (see Appendix B). During the baseline site visits conducted in September 2015, RMC researchers met with institutional research staff to assess each college's capacity to meet the data needs of the evaluation.

Overall, the consortium appears well positioned to meet the data needs of the evaluation. The Salesforce database is effective in collecting detailed information on all grant program participants, including demographics, enrollment, course progress, education outcomes, and employment outcomes. Data availability for the comparison group, needed for the impact analysis of grant funded programs, varies across the colleges but is satisfactory for 3 of the 4 colleges in the consortium.

### *Data collection timeline*

RMC will begin collecting academic data from the colleges in mid-2016, with the final data collection planned for November 2017. This data collection timeline will allow RMC to conduct an interim impact analysis, as well as a final impact analysis for the final evaluation report due in fall 2018. A data collection timeline for employment data is still being determined, and will be finalized once data sharing agreements have been established with the state workforce agencies.

Table 2. Data collection timeline for academic data from colleges

Time period covered	Students covered	Target Date
January 1, 2014 through August 31, 2015	Comparison group Treatment Group Year 1	June 15, 2016
September 1, 2015 through August 31, 2016	Treatment Group Year 2	November 15, 2016
September 1, 2016 through August 31, 2017	Treatment Group Year 3	November 15, 2017

## IMPACT ANALYSIS DESIGN

### Proposed design

RMC initially proposed using a ***difference-in-differences (DID)*** approach in conducting the impact analysis. The DID method essentially compares treatment and comparison groups in terms of outcome changes over time, relative to the outcomes observed at the pre-intervention baseline. A key benefit of this approach is that although the treatment and control groups may differ significantly on both observed and unobserved characteristics, these potentially confounding influences are controlled for by measuring change in the outcome rather than the outcome itself.

However, this approach relies on using cohorts of students from the redesigned programs (the “treatment group”) coupled with parallel cohorts in similar, non-redesigned programs (the “comparison group pool”), both using grant period and earlier time periods (see Table 3). The key is selecting a comparison group for which data are available over the same time period, and which was likely to have experienced the same exogenous factors but that did not experience the treatment. Similar, non-redesigned programs need to be chosen as comparison programs on the basis of several criteria: a) same department, b) same credit/non-credit status, c) similar duration, d) similar demographics, and e) enough available students compared to grant-affected programs.

Table 3. Cohort groups for the DID impact analysis design

Time period	Academic Year	Comparison (Similar programs in consortium colleges)	Treatment (Manufacturing/TDL programs in consortium colleges)
Prior Year	2014-15	Group 1	Group 3
Program Implementation	2015-16 2016-17	Group 2	Group 4

During the baseline site visits conducted in September 2015, RMC researchers met with key grant personnel at each college and gained a better understanding of each college’s program structures, as well as how the GMACW TAACCCT grant-funded programs of study were being implemented at each college. Based on observations from the site visit, RMC researchers have determined that the difference-in-differences method may not be appropriate for all colleges in the consortium. The four colleges in the consortium are relatively small, with a limited number of programs serving a small number of students. None of the colleges are offering concurrent non-grant funded, non-redesigned

courses or programs in the same fields of study as the grant-funded redesigned programs. As a result, identifying a comparison group made up of similar non-grant funded non-redesigned programs in the grant implementation period is challenging.

## Final design

RMC instead plans to implement a **retrospective cohort analysis**. In this type of analysis (see Table 4), outcomes for the group that received the intervention during the program implementation period (i.e. the treatment group) are compared to the outcomes for a comparison group that did not receive the intervention from a time period prior to the program implementation period. The difference in the outcome between the two groups can be understood as the effect of the treatment. Although this design is the best approach considering the realities of program set-up and grant implementation at the consortium colleges, it should be noted that the retrospective cohort design is less rigorous than the original DID approach.

Table 4. Cohort groups for the retrospective impact analysis design

Time period	Academic Year	Group assignment (manufacturing/TDL programs in consortium colleges)
Prior Year	2014-15	Comparison
Program Implementation	2015-16 2016-17	Treatment

## Propensity score matching

In addition, RMC plans to use propensity score matching<sup>3</sup> (PSM) to identify matches from the comparison group pool for the TAACCCT participants. Following Heinrich et al<sup>4</sup>, the RMC will explore the use of various matching algorithms in using the propensity score to match comparison units with treated units, bearing in mind the following: matching with or without replacement; how to assess (or set the standard) for proximity, i.e., the closeness of the match; whether and how to weight cases in the analysis; and number of comparison units matched to each treatment unit.

<sup>3</sup> Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika*, 70(1), 41-55.

<sup>4</sup> Heinrich, C., Maffioli, A., & Vazquez, G. (2010). *A primer for applying propensity-score matching*. Inter-American Development Bank.

A determination of which matching algorithm is appropriate to apply can only be made once we have a better understanding of the evaluation context, including, primarily, program design. Potential matching algorithms include “nearest neighbor” (NN); “caliper and radius” (CR); and “kernel and local interval” (KL). In the case of NN, a comparison group is matched to a participant based on the closest propensity score. In the case of CR, a caliper, or maximum propensity score distance, is established to exclude bad matches, and the NN within the caliper is used as a match (or all individuals within the caliper can be used as comparisons for the participant). In the case of KL, weighted averages of all cases in the comparison group are used as matches, with weights assigned by the closeness of the propensity score between the participant and comparison group member (with closer cases given higher weights). While our preference is for an NN approach, we would also consider an “NN within a caliper approach,” should GMACW sites be able to recruit sufficient numbers, due to the relative ease in applying multiple types of multivariate analyses to estimate causality.

Both of these approaches, however, fall under the “greedy matching” family of approaches, which is often criticized for its requirement of a relatively large common support region. Per Guo and Fraser<sup>5</sup>, the common support region is sensitive to different specifications of the model used to predict propensity scores, “because logistic regressions with different predictor variables and/or functional forms produce different common support regions. To solve the problem within the conventional framework of propensity score matching, the recommended procedure is for the analyst to test different models and conduct sensitivity analyses by varying the size of the common support region.” We will conduct such sensitivity analyses.

In addition, the principal matching strategy will be determined prior to data analysts examining outcome data. While we will attempt to match only within cohort, it is possible that we will identify cross-cohort matches. Given the potential for not finding matches for some GMACW participants among the comparison group, and the problems that this loss of study participants presents, we will also consider using multivariate analysis using propensity scores as sampling weights<sup>6</sup>. Once propensity scores have been estimated and a matching algorithm has been chosen, program impact will be calculated using Stata 14.

---

<sup>5</sup> Guo, S., & Fraser, M. W. (2010). Propensity score analysis: Statistical methods and analysis.

<sup>6</sup> Hirano, K., & Imbens, G. W. (2001). Estimation of causal effects using propensity score weighting: An application to data on right heart catheterization. *Health Services and Outcomes research methodology*, 2(3-4), 259-278.

## TREATMENT AND COMPARISON GROUP ASSIGNMENT

The treatment group will comprise of all of the students enrolled in GMACW TAACCCT grant-funded programs. Following the retrospective cohort design, the comparison group pool will include students enrolled in the same programs as the grant-funded programs of study, but from an earlier time period, prior to grant implementation. Grant implementation start dates varied by college and by individual program, ranging from January 2015 to September 2015. Thus, in general, the comparison group pool will comprise students enrolled in the same programs, from the time period beginning on January 1, 2014 and ending when the GMACW TAACCCT grant funding begins.

### Group assignment by college

During the baseline site visits conducted in September 2015, RMC researchers learned that each college is unique in their program-set up and as a result, program implementation at each college has its own distinctive features. This variation is documented at length in the evaluation team's baseline site visit report. The unique features of program implementation at each college have led RMC to identify comparison group pools for each individual college.

#### *ASU-Mid South*

ASU-Mid South is not offering any comparable non-grant funded non-redesigned programs (in the same fields of study as the grant-funded redesigned programs) while the TAACCCT grant is being implemented, so a DID approach is not feasible. However, since ASU-Mid South was offering comparable programs in the same fields of study prior to the grant being implemented, a pre-comparison group is available and the retrospective cohort approach is feasible.

Since ASU-Mid South received funding during prior rounds of the TAACCCT grant in the same industry sectors, it is important to note that the comparison group pool may include programs that were impacted by prior TAACCCT grants. Thus, it is likely that the comparison group will be an alternate-services group instead of a no-services group, and estimated impacts will capture the value of the distinctive features of the GMACW TAACCCT program on outcomes, compared to the interventions provided by prior grants.

Table 5. Treatment and comparison groups for ASU-Mid South

Institution	Program	Length of Program	Implementation Start Date	Treatment group	Comparison Group
Mid-South	Welding Technology	1 semester 2 years (degree)	1/27/2015	Students in program from 1/27/2015 to 8/31/2017	Students in program from 1/1/2014 – 12/31/2014
	Machine Technology	1 semester 2 years (degree)	6/1/2015	Students in program from 6/1/2015 to 8/31/2017	Students in program from 1/1/2014 to 5/31/2015
	Process Control Technology	2 semesters 2 years (degree)	11/1/2015	Students in program from 11/1/2015/2015 to 8/31/2017	n/a
	Diesel Technology	2 semesters 4 semesters 4-6 semesters (degree)	7/13/2015	Students in program from 7/13/2015 to 8/31/2017	Students in program from 1/1/2014 to 6/30/2015
	Aviation Technology	2 semesters 4 semesters 4 semesters (degree)	1/27/2015	Students in program from 1/27/2015 to 8/31/2017	Students in program from 1/1/2014 – 12/31/2015
	Mechatronics	1 semester 2 years (degree)	6/1/2015	Students in program from 6/1/2015 to 8/31/2017	Students in program from 1/1/2014 – 5/31/2015

### Southwest

Southwest is the only college in the consortium that is developing new programs (in welding and medical device finishing). Since these programs were not offered by the college prior to the grant being implemented, no direct pre- comparison group is available. There are also no non-grant funded non-redesigned programs (in the same fields of study as the grant-funded redesigned programs) while the TAACCCT grant is being implemented. As a result, neither the DID approach nor the retrospective cohort approach is feasible.

However, students in comparable programs in the same fields of study prior to the grant being implemented at the other colleges in the consortium could potentially be used as a comparison group. Once RMC has received data from all colleges, RMC will investigate the possibility of using a pre-comparison group from another consortium college. Additionally, RMC is working with the consortium to determine if Southwest’s Industry Readiness Training course can serve as a comparison group.

If a suitable comparison group cannot be found, RMC will be unable to conduct an impact analysis for the programs offered at Southwest, and will focus on outcomes analyses only.

Table 6. Treatment and comparison groups for Southwest

Institution	Program	Length of Program	Implementation Start Date	Treatment group	Comparison Group
Southwest	Medical Device Finishing	TBD	TBD	TBD	TBD
	Welding	TBD	TBD	TBD	TBD
	Getting ahead	32 contact hours	9/8/2015	Students in program from 9/8/2015 to 8/31/2017	n/a

*Moore Tech*

Moore Tech is not offering any comparable non-grant funded non-redesigned programs (in the same fields of study as the grant-funded redesigned programs) while the TAACCCT grant is being implemented, so a DID approach is not feasible. However, since Moore Tech was offering comparable programs in the same fields of study prior to the grant being implemented, a pre- comparison group is available and the retrospective cohort approach is feasible.

Table 7. Treatment and comparison groups for Moore Tech

Institution	Program	Length of Program	Implementation Start Date	Treatment group	Comparison Group
Moore Tech	Machining technology	2 year degree	1/5/2015	Students in program from 1/5/2015 to 8/31/2017	Students in program from 1/1/2014 to 12/31/2014
	Welding	1 year diploma	1/5/2015	Students in program from 1/5/2015 to 8/31/2017	Students in program from 1/1/2014 to 12/31/2014

*TCAT-Memphis*

TCAT-Memphis is not offering any comparable non-grant funded non-redesigned programs (in the same fields of study as the grant-funded redesigned programs) while the TAACCCT grant is being implemented, so a DID approach is not feasible. However, since TCAT was offering comparable programs in the same fields of study prior to the grant being implemented, a pre- comparison group is

available and the retrospective cohort approach is feasible. TCAT’s program design also incorporates a unique continuous enrollment model (for both the treatment and the comparison group); as a result, RMC will need to carefully select treatment and comparison group participants to ensure that there is no overlap between the treatment and comparison groups.

Table 8. Treatment and comparison groups for TCAT-Memphis

Institution	Program	Length of Program	Implementation Start Date	Treatment group	Comparison Group
TCAT Memphis	Aircraft Mechanics	18 months, 6 phases	5/18/2015	Students in program from 5/18/2015 to 8/31/2017	Students in program from 1/1/2014 to 5/17/2015
	Diesel Powered Equipment Technology	20 months	4/1/2015	Students in program from 4/1/2015 to 8/31/2017	Students in program from 1/1/2014 to 3/30/2015
	Machine Tool Technology	20 months	5/11/2015	Students in program from 5/11/2015 to 8/31/2017	Students in program from 1/1/2014 to 5/10/2015
	Welding, Brazing & Soldering	12 months	5/18/2015	Students in program from 5/18/2015 to 8/31/2017	Students in program from 1/1/2014 to 5/17/2015
	Truck Driving	7-weeks	5/18/2015	Students in program from 5/18/2015 to 8/31/2017	Students in program from 1/1/2014 to 5/17/2015

PSM will be used to create the final comparison group, made up of individuals drawn from the comparison group pool, who are as similar to GMACW participants as possible on a wide array of observed variables — e.g., race/ethnicity, age, gender, education level, English-language skills, work history — but who are not participating in GMACW

RMC is aware that the student population targeted by the GMACW TAACCCT grant, were also served by other grants, including prior TAACCCT grants. RMC anticipates that the individuals in the comparison group may have experienced some interventions and received services through these other grants. Thus, it is likely that the comparison group will not be a no-services group, and estimated impacts will capture the incremental value of the distinctive features of the GMACW TAACCCT program on outcomes, over and above the interventions provided by the other grants.

It is also the case that estimating impacts in this manner ensures that the impact of the treatment on the treated is measured, not simply the impact of the intent to treat. Both points are important to acknowledge at the outset. King and Heinrich<sup>7</sup> discuss the importance of estimating treatment-on-treated impacts. Those eligible for GMACW but who either choose not to participate, or who drop out of the program shortly after enrolling (within two weeks), will not be included in the treatment group.

PSM best practices suggest that both treatment and comparison group data should be drawn from the same sources, so that the measures used (for control and outcome variables) are identical or similarly constructed. In addition, to obtain impact estimates that are generalizable to populations similar to those covered by this study, the pool of comparison group members must have sufficient numbers of observations with characteristics corresponding to the treatment group.

## Estimation Methods

Based on previous PSM evaluations conducted by the RMC, and based on the impacts to be measured, covariates likely will include, at a minimum: age; gender; race/ethnicity; family size; marital status; and average hourly wage and hours worked per week in quarter prior to participation in GMACW. We anticipate that, over the period of the evaluation, data for some covariates may be missing. We intend to impute missing data using standard multiple imputation methods (e.g., *uvis* or *mi* in Stata 13). Cases with missing data on the outcome variables will not be used.

---

<sup>7</sup> King, C. T., & Heinrich, C. (2011). How effective are workforce development programs? Implications for US workforce policies. *Unpublished paper*.

## SAMPLE SIZE & POWER ANALYSIS

The GMACW consortium has set a target of serving a total of 1,500 students. The consortium's target goals are that 70% of participants will complete their program of study, 40% will be retained in their program of study, 90% will complete credit hours, 80% will earn credentials, 27% will enroll in further education, 47% will be employed after completion, 40% will be retained in employment after completion, and 19% will receive a wage increase after enrollment.

Researchers conducted a power analysis to determine the minimum detectable effect (MDE) for each outcome of interest<sup>8</sup>. The power of a test is the probability that the test will reject the null hypothesis when the null hypothesis is actually false; for example, a patient is told that they are cancer free when, in fact, they have the disease. This is different from statistical significance which is the probability of incorrectly rejecting a true statistical null hypothesis; for example a patient is told that they have cancer when, in fact, they do not. Using the power and statistical significance allows researchers to determine the sample size required to see a specific magnitude of effect.

Primary impacts will be evaluated for each of the grant outcomes. The table below indicates the measurable effect size for outcomes that ensures a statistical power of at least .80 with an assumed alpha of .05. Researchers acknowledge that they cannot know, in advance, two critical features to fully calculate the statistical power: the explanatory power (or  $R^2$ ) when program status is regressed on background characteristics, and the amount of overlap in propensity scores between the treatment and comparison groups, which may reduce the sample size. Thus, a best and worst case scenario which use different values for  $R^2$  and different assumptions as to any loss in sample size represent a likely range for the MDE.

For the purpose of the power test, the minimal measurable effect size (share of treated participants achieving an outcomes-share of comparison achieving an outcome) ranges from 1- 4%, depending on the outcome measured and the assumptions used to calculate statistical power. This means that if the measured impact is less than a provided percentage, the measured effect cannot necessarily be proven to be related to the treatment. Presented analysis includes only project-wide outcomes in all programs in all years. Prior to conducting the impact analysis an additional power analysis will consider the number of individuals enrolled in specific programs of interest to determine the minimum detectable effect for each program.

---

<sup>8</sup> Bloom, H. S. (1995). Minimum detectable effects a simple way to report the statistical power of experimental designs. *Evaluation review*, 19(5), 547-556.

Table 9. Minimum detectable effect, by type of outcome

Outcome	N	% of Participants	Minimum Detectable Effect	
			Best Case Scenario*	Worst Case Scenario**
Participants served	1500	100%		
Completing a funded program of study	1050	70%	3%	4%
Participants completing credit hours	1350	90%	2%	3%
Retained in program of study	600	40%	3%	3%
Participants earning credentials	1200	80%	3%	4%
Enrolled in further education	400	27%	2%	4%
Participants employed after study completion	700	47%	3%	4%
Retained in employment	600	40%	3%	3%
Participants who received a wage increase	280	19%	1%	2%
Wage increase amounts			\$398	\$512

Note: Assumes a one-to-one match between participants and control group members. The minimum detectable effect (MDE) calculated here represents a statistical power of .80, an alpha of .05, and a two-tailed test using the method described by Bloom (Bloom, 1995). The table reflects a scenario assuming that all enrollment goals are met.

\* Best case scenario results assume an  $R^2$  of .40 and a loss of 5% of the sample due to lack of common support in PSM.

\*\* Worst case scenario results assume an  $R^2$  of .20 and a loss of 15% of the sample due to lack of common support in PSM.

## THREATS TO VALIDITY

Threats to validity arise in any study that attempts to establish a causal relationship between an intervention and an observed outcome, and this evaluation of GMACW is no exception. The evaluation literature recognizes multiple threats to validity, including: “history threats,” in which factors other than the intervention could account for the outcomes; “maturation threats” that confound analysis of outcomes by suggesting that the observed outcomes are what would be expected of anyone as their knowledge and, in the case of GMACW, skills develop over time; “mortality threats,” which are brought about by participants dropping out of the program before completion; and threats related to regression to the mean. Additional threats include those related to systematic differences in data collection and those potentially resulting from selection bias. Moreover, the probability of even a limited number of participants dropping out of GMACW is high, with likely implications for the accuracy of the impact estimates.

However, each of these threats is mitigated through the use of a PSM method, and the inclusion of a comparison group. The identification and use of a comparison group permits the creation of a counterfactual framework, within which researchers can more accurately estimate causality. By identifying from among non-participants those people most likely, given an array of covariates on which they are matched with participants, to have participated in GMACW, researchers are able to estimate the net effect of the intervention, given participation. The difference in the observed outcomes between participants and (closely matched) non-participants can be assumed to be a result of GMACW. In order for PSM to effectively address these threats, it is essential that the comparison group be as comparable as possible.

## APPENDIX A. INTAKE FORM

<b>Greater Memphis Alliance for a Competitive Workforce TAACCCT 4 Intake Form</b>				
For Office Use Only: <input type="checkbox"/> Moore Tech <input type="checkbox"/> MSCC <input type="checkbox"/> TCAT-M <input type="checkbox"/> Southwest   Student ID # _____				
<b>BACK-GROUND</b>	The US Department of Labor has awarded a grant to fund the improvement of education in the manufacturing and transportation, distribution, and logistics (TDL) sectors to the Partner Colleges of the Greater Memphis Alliance for a Competitive Workforce (GMACW).			
<b>IDENTIFYING INFORMATION</b>	First Name:	Middle Initial:	Last Name:	
	Street Address:			
	City:	County:	State:	Zip:
	SSN:   -   -	DOB:   /   /	Home Phone: (   )   -	
	Cell Phone: (   )   -	E-mail:		
	2nd E-mail:	Emergency/Alternate Contact Name: Relation:		
	Emergency/Alternate Contact Phone: (   )   -	Emergency/Alternate Contact E-mail:		
<b>PARTICIPANT INFORMATION</b>	Authorized to work in the United States: (check only one box) <input type="checkbox"/> Yes, U.S. Citizen <input type="checkbox"/> Yes, Permanent Resident <input type="checkbox"/> Yes, Permanent Non-resident Work Visa <input type="checkbox"/> No			
	What is your highest Education Level Completed? (check only one) <input type="checkbox"/> High School graduate or equivalent <input type="checkbox"/> 1-2 years of college, technical or vocational school –Diploma or Certificate awarded <input type="checkbox"/> 1-3 years of college, technical or vocational school no degree		<input type="checkbox"/> Associates Degree or Equivalent <input type="checkbox"/> Bachelor's Degree or Equivalent <input type="checkbox"/> Advanced Degree beyond Bachelor's	
	Gender: <input type="checkbox"/> Female <input type="checkbox"/> Male	Race (select all that apply): <input type="checkbox"/> American Indian <input type="checkbox"/> Native Hawaiian/Pacific Islander <input type="checkbox"/> Asian <input type="checkbox"/> White <input type="checkbox"/> Black or African American		Hispanic/Latino: <input type="checkbox"/> Yes <input type="checkbox"/> No
<b>ENROLLMENT STATUS</b>	Are you currently enrolled: (Select one) <input type="checkbox"/> Full-time credit <input type="checkbox"/> Part-time credit <input type="checkbox"/> Non-credit <input type="checkbox"/> Not Yet Enrolled			
	Semester / Year First Enrolled:	Current Program of Study:	Type of Degree or Certificate:	
	Are you eligible to receive Pell grant funds for your training? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown			
<b>EDUCATIONAL ALTERNATIVES</b>	If the training / education program you are registering for did not exist, what is your best guess about what you would have done? (Select one)			
	<input type="checkbox"/> I would not have pursued any training / education <input type="checkbox"/> I would have enrolled in a similar program of study offered at this college. Which program? _____ <input type="checkbox"/> I would have enrolled in a similar program of study offered at another college. Which college? _____			
<b>STATUS</b>	Check all that apply: Individual with Disability: <input type="checkbox"/> Yes <input type="checkbox"/> No   Employed: <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> TAA Eligible <input type="checkbox"/> Dislocated Worker			

<b>VETERAN STATUS</b>	<p>Select one:</p> <input type="checkbox"/> Not a Veteran <input type="checkbox"/> Served on active duty for $\leq$ 180 days <input type="checkbox"/> Served on active duty for more than 180 days (including reservists during a period of war) <input type="checkbox"/> Spouse of an active duty veteran who was disabled, died, or captured while on active duty
<b>WORKFORCE OFFICE</b>	<p>If you were referred by a Workforce Center, which one? _____</p> <p>Are you currently registered with your local Workforce Career Center?: <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>If yes, please indicate the month and year of your most recent registration: _____</p>
<b>EMPLOYMENT STATUS</b>	<p>If employed: Employer Name: _____</p> <p>Address: _____ Contact Person: _____</p> <p>Position: _____ Hours / week: _____ <input type="checkbox"/> Working Part-time <input type="checkbox"/> Working Full-time</p> <p>Work Phone: (____) _____ Start Date: _____ Salary: \$ _____</p>
<b>EMPLOYMENT HISTORY</b>	<p>List your two previous jobs:</p> <p>[1] Position: _____ Employer: _____</p> <p>Start date: _____ End Date: _____ Hours /Week: _____ Hourly Wage: _____</p> <p>[2] Position: _____ Employer: _____</p> <p>Start date: _____ End Date: _____ Hours /Week: _____ Hourly Wage: _____</p>
<b>CONSENT</b>	<p>The information being requested will be used to determine grant eligibility and report educational outcomes for the Department of Labor (DOL) Trade Adjustment Assistance Community College and Career Training (TAACCT) 4 grant programs. Completion of all fields within the form is completely voluntary; however, failure to provide key eligibility information may result in incomplete information being reported which may affect program success. All information provided will be kept confidential and will only be used to determine program eligibility, referral to the appropriate training program, and evaluation of program progress.</p> <p>By signing below I am giving my consent to participate in this grant program and attest that the information provided is, to the best of my knowledge, complete and accurate. I authorize the disclosure of the information contained in this form to authorized third parties. I also authorize an employer to disclose information related to my employment to authorized third parties as required for evaluation of the grant as stated above and release my employers from liability for providing such information in good faith. This consent also includes authorization for the use of my photos, videos, and information in program publicity and student success stories. I certify that the information provided is to the best of my knowledge complete and accurate.</p> <p>In accordance with the Privacy Act of 1974 (Public Law No. 93-579, 5 U.S.C. 552a), you are hereby notified that the Department of Labor is authorized to collect information to implement the Trade Adjustment Assistance Community College and Career Training Program under 19 USC 2372 – 2372a.</p> <p>Participant's Signature: _____ Date: _____</p> <p>Signature: _____ Date: _____</p> <p style="text-align: center;">Program Counselor/Coordinator</p>

This workforce product was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The product was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The U.S. Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership.

## APPENDIX B. DATA REQUESTED FOR IMPACT EVALUATION

### INTAKE DATA

FIELD	DEFINITION	CODES	STUDENT TYPE	SOURCE
<b>Student ID</b>			GMACW participants	Salesforce database
<b>Institution</b>		Moore Tech, MSCC, TCAT-M, Southwest	GMACW participants	Salesforce database
<b>SSN</b>			GMACW participants	Salesforce database
<b>Intake date</b>			GMACW participants	Salesforce database
<b>Demographics</b>				
<b>DOB</b>	Student's date of birth	Date	GMACW participants	Salesforce database
<b>Authorized to work in the US</b>	Student's work authorization	Yes - U.S. Citizen, Yes - Permanent Resident, Yes - Permanent Non-resident Work Visa, No	GMACW participants	Salesforce database
<b>Highest Education Level Completed</b>	Student's highest education level completed	High School graduate or equivalent, 1-2 years of college, technical or vocational school – Diploma or Certificate awarded, 1-3 years of college, technical or vocational school no degree, Associates Degree or Equivalent, Bachelor's Degree or Equivalent, Advanced Degree beyond Bachelor's	GMACW participants	Salesforce database
<b>Gender</b>	Student's gender	Male, Female	GMACW participants	Salesforce database
<b>Race</b>	Student's race	American Indian, Native Hawaiian/Pacific Islander, Asian, White, Black or African American	GMACW participants	Salesforce database
<b>Ethnicity</b>	Student's ethnicity is Hispanic or Latino.	Yes, No	GMACW participants	Salesforce database
<b>Disabled status</b>	Students has a disability	Yes, No	GMACW participants	Salesforce database
<b>Employment status</b>	Student is employed	Yes, No	GMACW participants	Salesforce database

<b>TAA Eligible</b>	Student is TAA eligible	Yes, No	GMACW participants	Salesforce database
<b>Dislocated Worker</b>	Student is a dislocated worker	Yes, No	GMACW participants	Salesforce database
<b>Veteran Status</b>	Student's veteran status	Not a Veteran, Served on active duty for < 180 days, Served on active duty for more than 180 days (including reservists during a period of war), Spouse of an active duty veteran who was disabled, died, or captured while on active duty	GMACW participants	Salesforce database
<b>Enrollment Status</b>				
<b>Enrollment Status/ Course Load</b>	Student's course load	Full-time, part-time, Other	GMACW participants	Salesforce database
<b>Semester/year first enrolled</b>			GMACW participants	Salesforce database
<b>Current program of study</b>			GMACW participants	Salesforce database
<b>Type of certificate or degree</b>			GMACW participants	Salesforce database
<b>Pell grant eligible</b>		Yes, No, Unknown	GMACW participants	Salesforce database
<b>Education alternatives</b>		would not have pursued any training / education, would have enrolled in a similar program of study offered at this college, would have enrolled in a similar program of study offered at another college.	GMACW participants	Salesforce database
<b>Employment Status</b>				
<b>Current job position</b>			GMACW participants	Salesforce database
<b>Current job status</b>		Full-time, part-time	GMACW participants	Salesforce database
<b>Current job hours/Week</b>			GMACW participants	Salesforce database
<b>Current job start date</b>			GMACW participants	Salesforce database

<b>Current job salary</b>		GMACW participants	Salesforce database
<b>Employment History</b>			
<b>Previous Job 1 position</b>		GMACW participants	Salesforce database
<b>Previous Job 1 start date</b>		GMACW participants	Salesforce database
<b>Previous Job 1 end date</b>		GMACW participants	Salesforce database
<b>Previous Job 1 hours/week</b>		GMACW participants	Salesforce database
<b>Previous Job 1 hourly wage</b>		GMACW participants	Salesforce database
<b>Previous Job 2 position</b>		GMACW participants	Salesforce database
<b>Previous Job 2 start date</b>		GMACW participants	Salesforce database
<b>Previous Job 2 end date</b>		GMACW participants	Salesforce database
<b>Previous Job 2 hours/week</b>		GMACW participants	Salesforce database
<b>Previous Job 2 hourly wage</b>		GMACW participants	Salesforce database
<b>Workforce Office Status</b>			
<b>Workforce Center referral</b>		GMACW participants	Salesforce database
<b>Currently registered</b>	Student is currently registered with local Workforce Career Center Yes, No	GMACW participants	Salesforce database
<b>Registration Month &amp; Year</b>	Month & Year of student's most recent registration	GMACW participants	Salesforce database

ACADEMIC DATA

FIELD	DEFINITION	EXAMPLES OF CODES	STUDENT TYPE	SOURCE
<b>Student ID</b>			GMACW participants, Comparison Group	College IR data system
<b>SSN</b>			GMACW participants, Comparison Group	College IR data system
<b>Academic year</b>		2014, 2015, 2016, 2017	GMACW participants, Comparison Group	College IR data system
<b>Academic term</b>		Spring, Fall, Summer	GMACW participants, Comparison Group	College IR data system
<b>Student demographics</b>				
<b>DOB</b>	Student's date of birth	Date	GMACW participants, Comparison Group	College IR data system
<b>Gender</b>	Student's gender	Male, Female	GMACW participants, Comparison Group	College IR data system
<b>Race</b>	Student's race	Asian, American Indian or Alaskan native, Black, Native Hawaiian or other Pacific Islander, White, More than 1 race	GMACW participants, Comparison Group	College IR data system
<b>Ethnicity</b>	Student's ethnicity is Hispanic or Latino.	Yes, No	GMACW participants, Comparison Group	College IR data system
<b>Highest Education Level Completed</b>	Student's highest education level completed	Less than High School, High School, Some college without a degree, Associate degree, Bachelor degree, Graduate or professional degree	GMACW participants, Comparison Group	College IR data system
<b>Enrollment Status</b>				
<b>Student level</b>	Student level	Preparatory, Freshman, Sophomore, Junior, Senior, Graduate, Professional, Other Undergraduate, Other	GMACW participants, Comparison Group	College IR data system

		Graduate		
<b>Enrollment Status/ Course Load</b>	Course load	Full-time, part-time, Other	GMACW participants, Comparison Group	College IR data system
<b>Degree level</b>	The level of the degree/certificate that the student is pursuing.	Diploma, Certificate (one-year), Certificate (two-years), Associate (two-years), Baccalaureate, Non-degree Seeking Student	GMACW participants, Comparison Group	College IR data system
<b>Major / CIP code / ONET code</b>	U.S. Department of Education code for the major field of study.		GMACW participants, Comparison Group	College IR data system
<b>Cumulative GPA</b>	Student's cumulative GPA; student's average on all courses attempted		GMACW participants, Comparison Group	College IR data system
<b>Term GPA</b>	Student's GPA for the current reported term		GMACW participants, Comparison Group	College IR data system
<b>Total credit hours / Total clock hours</b>	Total credit or clock hours taken during the semester		GMACW participants, Comparison Group	College IR data system
<b>Academic outcomes - Course outcomes</b>				
<b>Course Number</b>	Official institutionally-assigned number to uniquely identify a course		GMACW participants, Comparison Group	College IR data system
<b>Course CIP</b>	U.S. Department of Education code for the major field of study the course belongs to		GMACW participants, Comparison Group	College IR data system
<b>Course credit hours or clock hours</b>	Number of credit hours or clock hours given for the course		GMACW participants, Comparison Group	College IR data system
<b>Course grade</b>	Grade given for the course		GMACW participants, Comparison Group	College IR data system
<b>Academic outcomes - Degree/certificate completion</b>				
<b>Date Degree/Certificate was earned</b>	Graduation date		GMACW participants, Comparison	College IR data system

<p><b>Type / Level of Degree/Certificate earned</b></p>	<p>The level of the degree/certificate that the student earned</p>	<p>Diploma, Certificate (one-year), Certificate (two-years), Associate (two-years), Baccalaureate, Non-degree Seeking Student</p>	<p>Group</p> <p>GMACW participants, Comparison Group</p>	<p>College IR data system</p>
<p><b>Major / CIP code / ONET code of Degree/Certificate earned</b></p>	<p>U.S. Department of Education code for the major field of study.</p>		<p>GMACW participants, Comparison Group</p>	<p>College IR data system</p>

EMPLOYMENT DATA

FIELD	DEFINITION	EXAMPLES OF CODES	STUDENT TYPE	SOURCE
<b>Wages</b>				
<b>SSN</b>			GMACW participants, Comparison Group	UI Wage data from state workforce agency
<b>Year Quarter</b>	Year & Quarter		GMACW participants, Comparison Group	UI Wage data from state workforce agency
<b>Employer ID</b>	Federal Employer ID		GMACW participants, Comparison Group	UI Wage data from state workforce agency
<b>Industrial classification</b>	Industry of employment		GMACW participants, Comparison Group	UI Wage data from state workforce agency
<b>Wages</b>	Wages per quarter		GMACW participants, Comparison Group	UI Wage data from state workforce agency