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Third-Party Evaluation of DOL Round 4 TAACCCT Grant  
*Mechatronics Re-envisioned*

**Final Evaluation Report Executive Summary**

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# Executive Summary

## **Introduction and Overview of Program**

In September 2014, Central Piedmont Community College (CPCC) was awarded a Department of Labor TAACCCT grant (Round 4) to develop and implement the *Mechatronics Re-Envisioned* (MRE) program. CPCC contracted with North Carolina State University's Industry Expansion Solutions (hereafter referred to as "the Evaluation Team") to be the third party evaluator for this program. The overarching goals of the MRE program, in alignment with the TAACCCT program goals, are to:

- 1) Increase attainment of degrees, certifications, certificates, diplomas, and other industry-recognized credentials that match the skills needed by employers to better prepare workers eligible for training under the Trade Adjustment Assistance (TAA) for Workers Program;
- 2) Introduce or replicate innovative and effective methods for designing and delivering instruction that address specific industry needs and lead to improved learning, completion, and other outcomes for TAA-eligible workers and other adults; and,
- 3) Demonstrate improved employment outcomes (U.S. Dept. of Labor SGA/DFA PY-13-10, p. 3).

In order to achieve these goals, five work plan activities were specified in the proposal. For the purposes of the evaluation, these activities can be broadly viewed as *five major program interventions*:

- 1) Curriculum Review, Modernization, and Assessment Development
- 2) Competency Validation and Credential Alignment
- 3) Personalized Student Support Services
- 4) Innovative Delivery of Technical Training
- 5) Organizational Management and Sustainability

The MRE Project design was based on a number of educational practices and models aligned with the Bill & Melinda Gates Foundation's (Gates Foundation) Completion by Design (CBD) initiative. Specific strategies include Competency-Based Learning<sup>1</sup>, technology

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<sup>1</sup> Krauss, S. (2017). How Competency-Based Education May Help Reduce Our Nation's Toughest Inequities. Lumina Foundation.

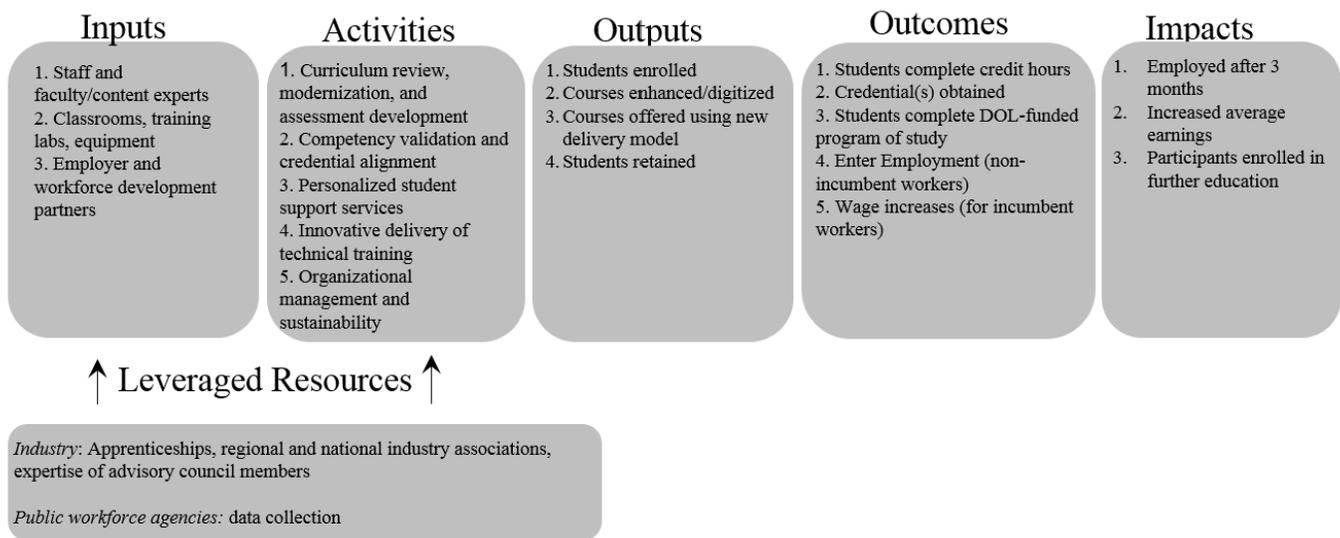
enabled/hybrid model for instructional delivery<sup>2</sup>, comprehensive student support (proactive/intrusive advising)<sup>3</sup>, and structured programs of study<sup>4</sup>.

### **Evaluation Design**

Evaluation of the MRE program was focused on achieving three major goals (succinctly stated): (1) Reporting program interactions and activities; (2) Assessing program implementation and process management; and (3) Evaluating MRE program impacts. Achievement of evaluation Goal 1 is a natural consequence of achieving evaluation Goals 2 and 3, which are described in further detail below.

The Evaluation Team’s standard practice for any evaluation project starts with generating a program logic model, which provides a dynamic and holistic view of the program. Logic models allow for the consideration of causal relationships, where specific activities (interventions) are expected to produce specific outputs and lead to measurable outcomes and/or impacts. See Figure E1 below for the MRE Program Logic Model.

*Figure E1: MRE Program Logic Model*



Using the logic model framework as a guide for the evaluation, the evaluation was then split into two main areas (formative and summative), which are described in more detail below. The **formative evaluation** was primarily shaped by three logic model elements; the inputs and

<sup>2</sup> Means, B., Toyama, Y., Murphy, R., & Bakia, M. (2013). The effectiveness of online and blended learning: A meta-analysis of the empirical literature. *Teachers College Record*, 115(3), 1-47.

<sup>3</sup> Swecker, H. K., Fifolt, M., & Searby, L. (2013). Academic advising and first-generation college students: A quantitative study on student retention. *NACADA Journal*, 33(1), 46–53.

<sup>4</sup> Completion By Design. (2012). *Completion by Design Pathway Principles*. Portland, Oregon.

activities, and to some degree outputs, with a focus on process quality, efficiency, and continuous improvement. Along with assessing fidelity to the activities described in the proposal, the formative evaluation involved a research focus on processes related to Work Plan Activities. Seven research questions were developed for the formative evaluation component, and are presented in more detail in Chapter 12 of the full report, but they can best be summarized as follows:

- How was the curriculum created?
- How was the curriculum delivered?
- What academic and career pathway support services were offered to students?
- What contributions did MRE program partners make to the program?

The methodology for performing the formative evaluation involved the periodic comparison of progress reports to project plan (as an indicator of staff capacity), but primarily depended on the Evaluation Team observing several meetings, and engaging in over 20 interviews, focus groups, surveys and discussions. A semi-standardized structure for gathering qualitative data from MRE program staff and faculty was followed in order to allow for probing questions that could adapt to, or expand upon, responses during interviews or focus groups. The surveys, interviews, focus groups, and informal discussions involved stakeholder groups such as the CPCC administration, and MRE program faculty and staff.

The evaluation design also included a **summative evaluation** component, which was primarily based on two logic model elements; the program outcomes and impacts (and how they may be associated with program interventions). The summative evaluation focuses on how the MRE program has impacted the degree to which retention, graduation (completion), program progress, *employment, and wages*<sup>5</sup> have improved by comparing the participants (the treatment group) with a comparison group comprised of similar students from historical cohorts. The summative evaluation also includes the presentation and review of descriptive statistics (Chapter 14 of full report), as well as calculations of inferential statistics based on a quasi-experimental model that was designed to determine the extent to which grant activities appear to affect performance measures for MRE participants in each institution. MRE participant (treatment group) characteristics and outcomes data were compared with a comparable historical

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<sup>5</sup> Employment and wage data was not available by the end of the grant for the summative evaluation, despite efforts by CPCC to retrieve this data from other state agencies.

(comparison) group after adjusting for selection bias using propensity scoring. The Evaluation Team compiled and analyzed data related to enrollment, student demographics, academic performance, and other sources to document the outcomes for program participants.

**Evaluation Findings**

The formative evaluation findings related to the MRE program fidelity to the five work plan activities are presented below in Table E1. The qualitative data gathered during the formative evaluation also led to the identification of lessons learned and MRE program implications, which are listed further in this document in Table E5. The table below shows an overall activity completion rating that was determined by examining the final outputs of each work plan activity task.

*Table E1: Project Fidelity to the Work Plan*

<b>Work Plan Activity</b>	<b>Status at End of Grant</b>	<b>Comments</b>
<b>1. Curriculum Review, Modernization, and Assessment Development</b>	<b>Completed</b>	None – all tasks complete by the end of the grant (during the extension period).
<b>2. Competency Validation and Credential Alignment</b>	<b>Completed</b>	All tasks complete by the end of the grant. Competency validation will be an ongoing activity to maintain relevance of the program to industry standards.
<b>3. Personalized Student Support Services</b>	<b>Completed</b>	None – all tasks complete by the end of the grant.
<b>4. Innovative Delivery of Technical Training</b>	<b>Completed Beyond Scope</b>	All tasks completed by the end of the grant. In addition, funds were approved to be reallocated from Work Plan Activity 1 to support augmented and virtual reality training simulation equipment.
<b>5. Organizational Management and Sustainability</b>	<b>Completed</b>	None – all tasks complete by the end of the grant.

Frequencies (projections and actuals) for the nine outcome measures originally outlined in the MRE Project Proposal are shown below in Table E2. The source of the ‘Projection’ data was the original proposal, and the source of the ‘Actual’ data was the Annual Performance Reports (APRs) submitted throughout the grant period.

Table E2: Outcome Indicators Included in MRE Proposal

Outcome Indicator	Year 1		Year 2		Year 3		Year 4	
	Proj.	Actual	Proj.	Actual	Proj.	Actual	Proj.	Actual
1. Total Unique Participants Served	0	42	90	96	76	127	N/A	67
2. Total Number of Participants Completing a TAACCCT Program of Study	0	0	19	49	26	58	N/A	50
3. Total Number of Participants Still Retained in Their Programs of Study (or Other TAACCCT-Funded Programs)	0	42	52	43	41	88	N/A	99
4. Total Number of Participants Completing Credit Hours	0	0	81	89	68	105	N/A	92
5. Total Number of Participants Earning Credentials	0	0	19	49	68	62	N/A	60
6. Total Number of Participants Enrolled in Further Education After TAACCCT-funded Program of Study Completion	0	0	2	0	3	0	N/A	0
7. Total Number of Participants Employed After TAACCCT-funded Program of Study Completion	0	0	14	0	20	0	8	0

8. Total Number of Participants Retained in Employment After Program of Study Completion	0	0	13	0	19	0	8	0
9. Total Number of Participants Employed at Enrollment Who Received a Wage Increase Post-Enrollment	0	0	N/A	2	32	5	55	59

The outcomes analysis plan involved a Comparison (historical) group of students, and a Treatment (MRE Participant) group of students who were affected by grant-funded activities. Both Comparison and Treatment data sets included demographic data, as well as student performance data. The outcomes/impact findings are presented below, and are organized by three program activities. The program activities investigated were: Overall participation in the Mechatronics Re-Envisioned (MRE) program (as a cohort), Re-envisioning (digitizing) selected courses, and Student support services. Data were collected and analyzed in order to determine what association, if any, program activities had on three participant outcomes: Retention, Program Progress, and Program Completion. The findings are listed below in Table E3.

*Table E3: Summary of Findings related to outcomes/impact analysis*

<b>Program Activity</b>	<b>Outcome Measure</b>	<b>Association between Program Activity and Outcome Measure</b>
<b>Participation in MRE Program</b>	<i>Retention</i>	Participation in the program did not significantly affect the Fall-to-Fall retention rate.
	<i>Program Progress</i>	Participation in the program had a significantly positive effect on program progress, even after adjusting for student GPA.
	<i>Program Completion</i>	Participation in the program had a significantly positive effect on program completion.

		A noteworthy positive indicator of the program’s value is that program participants who were employed had a significantly higher likelihood of program completion than did the comparison group participants.
<b>Re-envisioning (digitizing) selected courses</b>	<i>Retention</i>	None to report.
	<i>Program Progress</i>	Re-envisioning (digitizing) selected courses had no significant impact on the percentage of grades A, B, or C.
	<i>Program Completion</i>	None to report.
<b>Student support services</b>	<i>Retention</i>	Student support services did not have a significant effect on retention
	<i>Program Progress</i>	The students with a high number of support service events had a significantly lower percentage of grades A, B, or C than students with a low number of support service events. It is noteworthy that after adjusting for student GPA, the effect of a high number of support service events on the percentage of grades A, B, or C was no longer significant. One implication is that the lower percentage of grades found earlier may be due to more students who are struggling engaging additional support services.
	<i>Program Completion</i>	Student support services did not have a significant effect on program completion.

Due to the natural conditions and campus setting in which the MRE program activities took place, the impact findings above are expected to be generalizable to the routine community college setting. However, while threats to external validity are expected to be minimal, threats to internal validity exist. Threats to internal validity include the four-year passage of time and associated maturity changes of younger students. Furthermore, even though propensity scoring was used to reduce selection bias, the study design was quasi-experimental, not experimental.

Exploratory analysis: an exploratory analysis of outcomes was also conducted in order to detect any issues warranting further study, including the following:

- The Treatment group had a significantly higher percentage of students who were employed at program entry (78.1% vs. 43.7% for Comparison group)

- For the students employed at program entry, the Treatment group had a significantly higher percentage with full-time employment (61.4% vs. 46.0% for Comparison group)
- The mean age of the Treatment group students was significantly lower (24.1 vs. 30.4 for Comparison group)

It is important to note that the study was not designed to reach conclusions regarding the factors examined in the exploratory section, so these issues are only being suggested for further study.

The detailed evaluation plan specified two research questions related to outcomes/impact analysis. Drawing from the previous chapters containing descriptive statistics and/or hypothesis tests, the following table provides summary results that address these research question.

*Table E4: Research questions related to outcomes/impact analysis*

<b>Research Question</b>	<b>Characteristic / Issue</b>	<b>Analysis Results</b>
<b>1. What are the characteristics of the MRE program participants and how similar are these students to the students enrolled in the Comparison Group programs?</b>	<i>Gender</i>	The percentage of MRE participants who are females did not differ significantly from the percentage of Comparison Group participants who are females. In both groups, the percentage of females was low.
	<i>Age</i>	The mean age of MRE participants is significantly lower than the mean age of the Comparison Group. In both groups, female students were, on average, younger than the male students.
	<i>Race</i>	The racial diversity of the MRE participants did not differ significantly from the racial diversity in the Comparison Group. However, the MRE had a lower percentage of Blacks relative to the Comparison Group, and a slightly higher percentage of Whites.
	<i>Attendance: Full-Time vs. Part-Time</i>	The percentage of MRE participants who were classified as attending full-time did not differ significantly from the percentage of Comparison Group participants classified as attending full-time. In both groups, a slightly higher percentage were classified as part-time.
	<i>Employment</i>	The percentage of MRE participants who were employed at program entry was significantly higher than the Comparison Group participants who were employed at program entry.
	<i>Employment Status: Full-Time vs. Part-Time</i>	The percentage of employed MRE participants who were classified as employed full-time was significantly higher than the percentage of employed Comparison Group participants who were classified as employed full-time.

	<i>Pell Grant eligibility</i>	The percentage of MRE participants who were classified as Pell Grant eligible did not differ significantly from the percentage of Comparison Group participants who were classified as Pell Grant eligible.
	<i>Highest Education at Program Entry</i>	MRE participants had a significantly higher level of education upon entering the program compared to the Comparison Group.
	<i>Transfer Credits</i>	A significantly higher percentage of MRE participants had transfer credits upon entering the program compared to the Comparison Group.
<b>Research Question</b>	<b>Characteristic / Issue</b>	<b>Analysis Results</b>
<b>2. How do participant outcomes (credit, certificates, degree attainment, retention, employment, wages) compare with students in the Comparison Groups?</b>	<i>Retention</i>	73.68% of MRE participants were retained, compared to 60.32% of comparison group participants who were retained. However, this difference in percentage was not found to be statistically significant (.05).
	<i>Progress (as measured by receiving Grade A, B, or C on a course).</i>	MRE program participants had a significantly higher proportion of grades A, B, or C than those in the Comparison Group.
	<i>Program Completion</i>	MRE program participants were more likely to complete the program than non-MRE-participants.

**Implications and Conclusions**

The implications of the Mechatronics Re-Envisioned program are organized around *Lessons Learned*, and *Sustainability*; each of which are summarized in Tables E5 and E6 below.

*Table E5: Implications of the Program – Lessons Learned*

<b>Theme</b>	<b>Comments</b>
<b>Digitizing Process</b>	<ul style="list-style-type: none"> <li>• The level of training and preparation that faculty had prior to working with the vendor. Many mentioned that it would have been beneficial to them to have known more about how that process would unfold beforehand so that they could have been better prepared for interactions with the vendor.</li> <li>• Members of the project team shared that they would have started the procurement process to select the digitizing company as soon as the grant award was official to mitigate these setbacks in the project timeline. So,</li> </ul>

	<p>for projects with a similar digitizing process, a longer timeline for vendor procurement might be helpful, particularly if international vendors are being considered.</p> <ul style="list-style-type: none"> <li>• Important to ensure that roles and expectations are well defined up front (e.g. established review cycles, edits and revisions, approval process for final deliverables).</li> </ul>
<b>Instructional Design and Effectiveness</b>	<ul style="list-style-type: none"> <li>• Factor in more time for faculty to transition the course plan to accommodate the hybrid setting, which presents unique challenges in deciding what to include in the online component and what to include in the face-to-face component.</li> <li>• Faculty expressed some concern regarding the competency level of students who pass a Fast Track module but did not participate in the optional hands-on lab experiences, but this is partly due to the design of the Fast Track program, allowing incumbent workers who have hands-on experience to demonstrate that through the assessment (testing) process.</li> <li>• One faculty member mentioned that the flipped classroom has presented a unique challenge, in that some students complete the activities quicker than others, and additional activities had to be created for students who were slightly ahead of others.</li> <li>• The pace of the Fast Track was perceived to be too fast for participants who were not very experienced in the mechatronics field, so more restrictive participation in the program might be helpful</li> </ul>
<b>Student Support Services</b>	<ul style="list-style-type: none"> <li>• The focus areas of the support services should change throughout the semester. In general, at the beginning of the semester, students tend to be more curriculum-focused (which courses to take, credential completion, etc.). However, near the end of the semester, students tend to seek more assistance on getting a job. For students struggling academically, tutoring and other academic support may be needed throughout the semester.</li> <li>• Taking time in the classroom to provide awareness of career options can help prompt students to be more proactive in considering their career preferences and exploring career options.</li> </ul>
<b>Industry Involvement</b>	<ul style="list-style-type: none"> <li>• Industry involvement in identification of competencies was not only informative, but made industry more receptive to the program.</li> </ul>

Table E6: Implications of the Program - Sustainability

Theme	Comments
<b>Assessment of Prior Learning</b>	The establishment of the Fast Track Mechatronics program can potentially serve as an entry point for incumbent workers seeking higher education. This would start with the Fast Track credentials and transitioning into the Associate's degree program.
<b>Innovative Delivery Methods</b>	The added flexibility that is gained from adding web-enhancements to courses may impact the ongoing sustainability of the program. More and more programs are being transitioned to an online or web-enhanced format, which puts the Mechatronics Re-Envisioned program on the cutting edge of technical training delivery.
<b>Competency Based Education (CBE)</b>	With the Mechatronics Re-Envisioned project being an example of a successful CBE implementation, CPCC can serve as advocates in the state of North Carolina as other colleges join this effort.
<b>Measuring Effectiveness of Modernized Curriculum</b>	In the future, the Mechatronics staff at CPCC may consider deploying supplemental surveys (during the college-wide course evaluation survey window) to collect qualitative data from students in re-envisioned courses to gauge perception indicators such as satisfaction, rigor, quality, learning outcomes, among others. This data will be important to consider when assessing the effectiveness of digitization (perhaps considered in other college departments / contexts).
<b>Standardization of Mechatronics Lab and Curriculum Statewide</b>	As a leader in Mechatronics education in the state, CPCC has the opportunity to influence the standardization of Mechatronics Labs and Curriculum at the community college system-level. The team at CPCC has reinvigorated the work of a Mechatronics consortium in NC, which has further opportunities to build awareness about the program and further promote buy-in and reach state-wide. Both of these factors contribute to sustaining the program through advocacy and awareness, backed by industry support. Further, when considering a recruitment pipeline, the heightened awareness of the program, not only among local industry, but among other community colleges and the community college system, can promote increases in students pursuing the Mechatronics degree track.
<b>Student Data / Outcomes Tracking</b>	In the future there are opportunities for CPCC to benefit from improved data sharing amongst the workforce development system in NC (that includes NC Commerce). As noted in Chapter 17, a limitation to the study was the lack of integration and accessibility of data systems that would allow for detailed employment and wage data matching with MRE participants to track employment outcomes. On a separate, but

	<p>related, note on data quality and availability, there may be value in a future investment (or expansion of existing systems) to further the case management functionality of student support services tracking to allow for more in depth analysis of the impact of student support services. A more consistent data structure for student support service tracking would enable a more in-depth analysis to explore the impact of specific support needs and services on various aspects of student success, such as retention, completion, and grades.</p>
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