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Using EvaluateUR-CURE and Evaluate-Compete to Provide Student Feedback While Documenting Student Learning Gains Defined by ABET EAC and ETAC Performance Indicators

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Abstract

Evaluate-Compete (E-Compete) is a new variant of the EvaluateUR method specifically designed for teams of students preparing to participate in engineering/design competitions as part of a capstone course or as an extracurricular activity. In addition to a set of general outcomes such as communication, problem solving, ability to overcome obstacles, and teamwork, competition-specific outcomes are included based on competition guidelines and rubrics used by competition judges. The E-Compete general and competition-specific outcome categories and defining components have been mapped to the performance indicators/rubrics associated with ABET Engineering Accreditation Commission (EAC) and Engineering Technology Accreditation Commission (ETAC) Criterion 3 Student Outcomes. To date, outcomes that align with judges' rubrics have been developed for the MATE ROV (remotely operated underwater vehicle), Baja SAE, and Solar District Cup competitions. E-Compete can be adopted by other engineering/engineering technology programs offering design experiences related to collegiate competitions as an approach to provide students with constructive feedback about their progress, while at the same time tapping into their students' metacognitive skills. This in turn is invaluable to the students as they continue their education and enter the workplace. E-Compete has been successfully piloted in a capstone engineering technology course where students are designing, building, and testing a Baja vehicle in preparation for the competition.

Introduction

The EvaluateUR method provides statistically reliable assessments of student learning growth in a wide variety of outcome categories identified as essential to success in the workplace. The method differs from more traditional approaches to assessing student outcomes because it is integrated directly into the research/engineering design experience. A unique feature of the EvaluateUR method is its emphasis on metacognition by helping students learn and practice the discipline of realistic self-assessment. Thus, the method also serves as a learning tool for students, helping them to become more aware of their academic and professional strengths and weaknesses while supporting their efforts to identify strategies for expanding their knowledge and improving their metacognitive skills.

The method comprises several variants that reflect different educational settings. Currently, the method includes EvaluateUR, EvaluateUR-CURE, and Evaluate-Compete (https://serc.carleton.edu/evaluateur). EvaluateUR, the initial variant of the method, was developed at SUNY Buffalo State University to provide feedback about student learning outcomes from a summer research program with students conducting 8-10 weeks of independent research with mentoring provided by faculty. For more details about the development of the assessment model see [1, 2, 3]. With funding from the NSF, the Buffalo State University model was expanded and designated as EvaluateUR. EvaluateUR has been shown to be a valuable learning tool [4,5] with its key features summarized in Table 1.

Table 1. Key features of the EvaluateUR method

Students assessed in 10 outcome categories each defined by several components that include both content knowledge and outcomes critically important in the workplace.
Option to add additional outcomes that reflect specific program-wide objectives.
Before research/project begins, students answer open-ended questions to share their thoughts about the research process.
To assess student progress, at the mid-point and end-of-research, all outcome components are self-scored by the students using a five-point scale and accompanying scoring rubric. The scores indicate how often a desired student outcome was observed (5-Always to 1-Not yet). To easily view the scores, automatically generated reports show scores assigned to each outcome component.
Conversations are conducted after assessments providing the opportunity for students and mentors/advisors to consider progress and help students understand their strengths and weaknesses in working to achieve these outcomes and develop or enhance related metacognitive skills.
Summary statistics are automatically generated with an online guide explaining ways to use generated data.

EvaluateUR was modified to support course-based undergraduate research experiences (CUREs). This variant of the method is called EvaluateUR-CURE (E-CURE for short) and its design retains the same key features of EvaluateUR. E-CURE supports both one semester/quarter CUREs as well as full-year CUREs with the full year version including an additional set of assessment scores by both the CURE Instructor and all the students enrolled in the CURE. The development of E-CURE is described in [4, 5]. The two biggest differences between EvaluateUR and E-CURE are: (1) only students score the initial assessment; and (2) CURE instructors can select a subset of outcomes to use on the subsequent assessments. This reflects the practicality of a single CURE instructor's ability to adequately observe all students in the CURE and confidently score the student. Reducing the number of outcomes reduces this burden. Both versions of E-CURE provide automated messages sent according to the default dates set by the CURE instructor. Following each assessment, students have access to a report that shows the scores assigned to the outcome components. In addition to the score report, CURE instructors are provided with summary statistics for each student as well as whole class data that are useful in individual/group/whole class conversations. E-CURE was found to be beneficial in helping engineering technology students become aware of the knowledge and skills valued in the workplace while at the same time receiving timely feedback from the course instructor. The outcomes used in E-CURE aligned well with ETAC ABET student outcomes as described in [1, 5]. To further extend this benefit of E-CURE, a set of 12 metacognitive exercises are available. These exercises are freely available on the EvaluateUR method website https://serc.carleton.edu/evaluateur/method/metacognition/index.html along with explanatory resources and a guide.

The third variant of the EvaluateUR method was introduced to support students preparing to participate in engineering design competitions. This variant - known as Evaluate-Compete - also shares many of the key features listed in Table 1 and builds upon the structure and functionality of the other two variants. In addition to the set of general outcomes (similar to the list used in the other two variants), E-Compete includes competition-specific outcome categories and components. There currently are two options for E-Compete. The first option largely follows the sequence of steps followed in E-CURE with only students completing the initial assessment and team advisors having the ability to select a sub-set of outcomes for the next two assessments. It should be emphasized that a course instructor or team adviser is also scoring the students using the same set of outcomes and scoring rubric making this a direct assessment measurement (Table 2). In common with the other variants, a dashboard is provided for setting up E-Compete (e.g., adding names and emails for team members, choosing dates for assessments, and selecting outcomes). A new version of E-Compete (referred to as E-Compete 2.0) eliminates the need for team advisors to score the students. The introduction of the 2.0 option reflects: (1) team members often work independently of the team advisor making it difficult for them to observe the students and assign a score with confidence; and (2) the team members might be interacting with multiple advisors and/or are working in units responsible for a particular aspect of the engineering design. Table 2 highlights the similarities and differences in the two E-Compete options. In place of receiving assessment scores from the team advisor, prompts are provided to both the team members and team advisor that are intended to generate dialog during post-assessment debriefs (e.g., a debrief follows each of the 3 pre-competition assessments with an optional debrief session following the competition). Recognizing that the metacognitive exercises developed for E-CURE were intended to be homework or short in-class activities, a metacognition card game was developed for E-Compete to strengthen these habits which can improve performance in any domain. Each card offers a way for students to reflect on their own learning and how they might make adjustments to learn more effectively. The card game is divided into three major themes (People, Persistence, and Problem Solving) and can be played at any point in a work session and throughout the entire experience.

Table 2. Comparison of E-Compete Options

Similarities • Team members score assessments • Same set of general and competition-specific outcomes • Assessments done online with automated reminders when to complete particular steps • Assessments aligned with competition judges' rubrics • Score reports automatically generated • Option for post-competition de-brief
Differences • Both team members and advisor score assessments (Version 1.0) and only team members score the assessments (Version 2.0)

- Conversations follow each assessment (Version 1.0) and Set of Prompts are sent to team members and team advisor in advance of debriefs that take place after each assessment (Version 2.0)

E-Compete and Performance Indicators for Direct Assessment of Student Outcomes

E-Compete's outcome categories and defining components correlated to ETAC/EAC performance indicators (PIs). Table 4 summarizes the relevance of ABET Criterion 3 Student Outcomes presented in Table 3 to the corresponding outcome components of E-Compete. This mapping is similar to that reported for E-CURE as based on a two-semester senior design course [1,5]. The preface of Criteria for Accrediting Engineering Technology Programs [6] and Criteria for Accrediting Engineering Programs [7] state that effective assessment uses relevant direct, indirect, quantitative and qualitative measures as appropriate to the outcome being measured. It is a common practice articulated in ABET training that assessments via rubrics or other data collection mechanisms would be primary or direct evidence. Rubrics (or performance indicators) provide a focused approach to measuring students' attainment of intended outcomes. Each ETAC or EAC ABET required student outcome listed in Criterion 3 can be further narrowed down to the set of performance indicators (PI). These indicators are constructed based on capabilities, which in turn, are defined as what an individual is expected to know and be able to do by the time of entry into professional practice in a responsible role and consists of knowledge, skills, and attitudes [8]. In the context of undergraduate engineering and engineering technology education, capabilities are construed as what students should know and be able to apply by the time of graduation, and therefore are considered as granular components of student outcomes. Although the Professional Engineering Body of Knowledge [8] has a substantial number of capabilities in each category, not all of them were selected as PIs to avoid overburdening faculty with assessment. Each program has the flexibility to select the capabilities most relevant to their program's educational objectives and modify, extend, or reduce the number of PIs presented in Table 3.

Table 3. ETAC and EAC Criterion 3 Student Outcomes and Performance Indicators

	ETAC Criterion 3 Student Outcomes		**EAC Criterion 3 Student Outcomes**
PI #	**SO1: An ability to apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve broadly defined engineering problems appropriate to the discipline**	**PI #**	**SO1: An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics**
1	Apply material from their discipline to the design of a project	1	Apply material from their discipline to the design of a project
2	Identify and acquires new knowledge as a part of the problem-solving/design process	2	Apply an appropriate area of mathematics in the planning or design of a portion of a facility, structure, system, or product
3	Apply an appropriate area of mathematics in the planning or design of a portion of a facility, structure, system, or product	3	Apply trigonometry, probability and statistics, differential and integral calculus, multivariate calculus, and differential equations to solve engineering problems
4	Apply critical thinking skills through the application of the scientific method and/or	4	Apply critical thinking skills through the application of the scientific method and/or

	associated inquiry processes in one or more areas of natural science		associated inquiry processes in one or more areas of natural science
	SO2: An ability to design systems, components, or processes meeting specified needs for broadly defined engineering problems appropriate to the discipline		**SO2: An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors**
1	Formulate the problem and analyze constraints	1	Formulate the problem and analyze constraints
2	Establish design requirements	2	Establish design requirements
3	Generate alternative solutions	3	Generate alternative solutions
4	Build a prototype/perform simulation when it is impossible to build a prototype	4	Build a prototype/perform simulation when it is impossible to build a prototype
5	Analyze performance through testing/simulation	5	Analyze performance through testing/simulation
6	Assess the strength and weaknesses of design	6	Assess the strength and weaknesses of design
7	Identify next steps to improve on design	7	Identify next steps to improve on design
	SO3: An ability to apply written, oral, and graphical communication in broadly defined technical and non-technical environments; and an ability to identify and use appropriate technical literature		**SO3: An ability to communicate effectively with a range of audiences**
1	Apply written, oral, and graphical communication in both technical and non-technical environments	1	Apply written, oral, and graphical communication in both technical and non-technical environments
2	Identify and use appropriate technical literature	2	Identify and use appropriate technical literature
	SO4: An ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes		**SO4: An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts**
1	Identify types of experiments (or simulation when experiment is not possible or feasible) conducted by engineers for a specific application	1	Analyze a situation involving multiple conflicting professional and ethical interests to determine an appropriate course of action
2	Design an experiment (or simulation when experiment is not possible or feasible) to test a hypothesis, such as the potential effectiveness of a proposed solution to an engineering problem or to validate functionality of a device or system	2	Assemble appropriate resources to assist in the resolution of an ethical dilemma and formulate the solution
3	Conduct an experiment (or simulation when experiment is not possible or feasible) and analyze and interpret the results	3	Explain the barriers to global interaction including cultural mores and political and socioeconomic systems
4	Develop and recommend a plan of action based, in part, on the experimental (or simulation) results	4	Discuss the importance of finding and implementing technologies, standards, and products from global sources
		5	Analyze the impacts of a project component on different stakeholders
		6	Assess the environmental, economic, and societal impacts of project alternatives and

			explain the impacts of those alternatives to project stakeholders
	SO5: An ability to function effectively as a member as well as a leader on technical teams		**SO5: an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives**
1	Work Toward Group Goals	1	Work Toward Group Goals
2	Use Effective Interpersonal Skills	2	Use Effective Interpersonal Skills
3	Contribute to Group Maintenance	3	Contribute to Group Maintenance
4	Take on a Variety of Roles	4	Takes on a Variety of Roles
		5	Identify discrete work tasks and budgets for a portion of a project
		6	Direct the project work of one or more team members
		7	Monitor project schedules and costs using appropriate tools such as Gantt charts, other bar charts, precedence diagrams, or other appropriate tools
			SO6: An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
		1	Identify types of experiments (or simulation when experiment is not possible or feasible) conducted by engineers for a specific application
		2	Design an experiment (or simulation when experiment is not possible or feasible) to test a hypothesis, such as the potential effectiveness of a proposed solution to an engineering problem or to validate functionality of a device or system
		3	Conduct an experiment (or simulation when experiment is not possible or feasible) and analyze and interpret the results
		4	Develop and recommend a plan of action based, in part, on the experimental (or simulation) results
			SO7: An ability to acquire and apply new knowledge as needed, using appropriate learning strategies
		1	Identify and acquire new knowledge as a part of the problem-solving/design process
		2	Identify and use appropriate technical literature
		3	Perform scholarly source analysis

Table 4. E-Compete General Outcome Components and ETAC/EAC Performance Indicators

Outcome Categories	Evaluate-Compete Outcome Components	ETAC	EAC
Communication	Demonstrates the ability to communicate the engineering process and vehicle design to a wide audience	SO-3, PI 1	SO-3, PI 1
	Effectively uses images, diagrams, and data to	SO-3, PI 1	SO-3, PI 1

	communicate designs and processes		
	Writes clearly and concisely using correct grammar, spelling, syntax, and sentence structure	SO-3, PI 1	SO-3, PI 1
Creativity	Shows ability to approach problems from different perspectives	SO-2, PI 3	SO-2, PI 3
	Effectively connects multiple ideas/approaches	SO-2, PI 3	SO-2, PI 3
	Demonstrates the ability to apply knowledge and skills in new and innovative ways	SO-1, PI 2	SO-7, PI 1
Entrepreneurship	Demonstrates the ability to apply skills in new and innovative ways to creative a product or service that meets customers' needs	SO1, PI 2	SO-7, PI1
	Demonstrates an understanding of business operations and budget	PM-3*	SO-5, PI 7
	Demonstrates the ability to manage a project	PM-1*	SO-5, PI 5
Autonomy	Demonstrates an ability to work independently and identify when guidance is needed	PM-2	SO-5, PI 6
	Accepts constructive criticism and uses feedback Effectively	SO-1, PI 2	SO-7, PI 1
	Shows flexibility and a willingness to take risks and try again in the event of failure	SO-1, PI 2	SO-7, PI 1
Ability to Deal with Obstacles	Is not discouraged by setbacks or unforeseen events and perseveres when challenges are encountered	SO-5, PI 1	SO-5, PI 1
	Shows flexibility and a willingness to take risks and try again	SO-1, PI 2	SO-7, PI 1
	Demonstrates ability to quickly improvise and implement a solution to fix a design or equipment problem	SO-2, PI 6	SO-2, PI 6
Intellectual Development	Recognizes that problems are often more complicated than they first appear	SO-2, PI 2	SO-7, PI 1
	Approaches design challenges with an understanding that there can be more than one acceptable solution	SO-2, PI 3	SO-2, PI 3
	Displays insight into the limits of their knowledge and an appreciation for what isn't known	SO-1, PI 2	SO-7, PI 1
Critical Thinking and Problem Solving	Maintains a posture of open-minded skepticism wh considering potential solutions to design and operational challenges	SO-2, PI 6	SO-2, PI 6
	Looks for the root causes of problems and develops or recognizes the most appropriate corrective actions	SO-2. PI 6	SO-2, PI 6
	Demonstrates the ability to evaluate alternative	SO-2, PI 3	SO-2, PI 3

	designs and/or operational solutions		
Project Knowledge and Skills	Displays an understanding of the engineering and scientific principles and practices relevant to vehicl design and operation	SO-1, PI 1 SO-1, PI 4	SO-1, PI 1 SO-1, PI 4
	Possesses the skills needed for project design and operation	SO-1, PI1	SO-1, PI 1
	Demonstrates mastery of the skills required to compete successfully	SO-1, PI 1	SO-1, PI 1
Teamwork/ Collaboration	Behaves with a high level of collegiality and treats others with respect	SO-5, PI 2	SO-5, PI 2
	Shows ability to work effectively in a team	SO-5, PI 2	SO-5, PI 2
	Willingly shares knowledge among team members and amongst other teams (as applicable)	SO-5, PI 3	SO-5, PI 3
Ethical Conduct	Understands that altering or fabricating data is highly unethical		SO-4, PI 1
	Realizes that distorting or misstating research findings is unethical and may harm others who rely on your professional integrity		SO-4, PI 1
	Recognizes the imperative of giving credit to sources used in research and to those who may have provided helpful advice or assistance		SO-4, PI 1

*Note: Here and in all subsequent tables PM means Project Management capabilities.
For ETAC they are defined as: PM-1 is equivalent to EAC SO-5, rubric 5: Identify discrete work tasks and budgets for a portion of a project; PM-2 is equivalent to EAC SO-5, rubric 6: Direct the project work of one or more team members; PM-3 is equivalent to EAC SO-5, rubric 7: Monitor project schedules and costs using appropriate tools such as Gannt charts, other bar charts, precedence diagrams, or other appropriate tools.

E-Compete and Collegiate Competitions

There are several collegiate engineering design competitions involving professional societies that serve to illustrate how each aligns with the EvaluateUR method and in particular E-Compete. Three of these competitions are the Baja SAE (https://www.bajasae.net) sponsored by SAE International, underwater robotics (remotely operated vehicles) MATE ROV (https://materovcompetition.org) sponsored by the Marine Technology Society, and Solar District Cup Collegiate Design Completion (https://www.energy.gov/eere/solar/solar-district-cup) sponsored by the Department of Energy. For these and other engineering and engineering technology competitions, E-Compete can be integrated either as part of a design course taught in a single semester or as a two-semester capstone course or used by a team advisor for design projects conducted as an extracurricular activity. With the two options for implementing E-Compete, course instructors and team advisors can decide which option best serves their particular teaching/advising styles.

The Baja SAE is a collegiate competition especially for engineering and engineering technology students. It requires students to design and build an off-road vehicle that will survive a range of conditions that include rough terrain and (possibly) mud and water. Participating in the competition offers teams of students opportunities to explore real work situations as they identify and solve myriad technical challenges in designing, testing, and manufacturing. The competition also presents realistic business issues to students as they deal with project funding, time management, and team dynamics. Regional competitions are hosted by colleges across the country and participation is based on successful applications that include documentation of the vehicle's design and performance.

The MATE ROV Competition challenges students to apply math, electronics, engineering, and physics toward solving problems based on real-world workplace scenarios. Two of the five competition levels (Pioneer and Explorer) are intended for community college and college/university students and require students to design and build vehicles to complete in simulated real-world missions. Students also must organize themselves into mock companies that require them to apply entrepreneurial thinking as well as business and project management skills. The students compete at the 'worlds' alongside teams from across the US and internationally.

The Solar District Cup supports multidisciplinary teams of students to design and model optimized distributed energy systems for a campus or urban district composed of groups of buildings served by a common electrical distribution feeder. By integrating solar, storage, and other technologies across mixed-use districts, the competition engages students in engineering, urban planning, finance, and related disciplines to reimagine how energy is generated, managed, and used.

Tables 5 illustrates the alignment between the Baja SAE competition-specific outcome components and the Criterion 3 student outcomes and associated performance indicators. Competition-specific outcome categories and components were devised based on competition judging criteria. Tables outlining the alignments between project-specific outcomes for the Solar District Cup and MATE ROV competitions are presented in Appendices 1 and 2.

Table 5. Alignment between Baja-specific Outcome Components and ETAC/EAC Performance Indicators

Baja SAE-Specific Outcome Categories	Baja SAE-Specific Outcome Components	ETAC	EAC
Vehicle Components and Safety	Demonstrate knowledge about the function of the Baja SAE vehicle components including: General Design Requirements, engine, roll cage, driver restraint, driver equipment, fuel system, vehicle controls, cockpit, powertrain guards, electrical system, tow points, fasteners & attachments, and vehicle identification & markings	SO-1, PI 1 SO-3, PI 2 (Include references and codes and standards)	SO-1, PI 1 SO-3, PI 2
	Demonstrate an understanding and application of safety principles to personnel, equipment, and operations	SO-2, PI 1 SO-2, PI 2	SO-2, PI 1 SO-2, PI 2

Design Evaluation (Static Event)	Demonstrate the ability of the team to create the vehicle design	SO-1, PI 4 SO-2, PI 2	SO-1, PI 4 SO-2, PI 2
	Demonstrate the ability of the team to fabricate and test the vehicle	SO-2, PI 4	SO-2, PI 4
	Demonstrate the ability to determine how the vehicle works as a whole using: computer aided drafting, analysis of design components, testing and refinement of components, manufacture of a working version of component, and serviceability of component This applies to the following systems: Suspension, steering, brakes, drivetrain/powertrain, 4WD/AWD, and chassis and ergonomics	SO-1, PI 1 SO-2, PI 4 SO-2, PI 5 *Criterion 5 Curriculum, with respect to MET program specific Criterion B)*	SO-1, PI 1 SO-2, PI 4 SO-2, PI 5
Cost Evaluation (Static Event)	Demonstrate the ability to propose various idea(s) for possible cost reduction	SO-1, PI 1 SO-2, PI 3	SO-1, PI 1 SO-2, PI 3
	Demonstrate the ability to fully develop cost reduction ideas	SO-1, PI 4 SO-2, PI 5	SO-1, PI 4 SO-2, PI 5
	Demonstrate the ability to perform the virtual analysis and/or real-world testing that students have completed on the cost reduction proposals.	SO-2, PI 5	SO-2, PI 5
	Demonstrate the ability to describe how the cost reduction affects the component's performance, durability, or other aspects	SO-2, PI 5 SO-2, PI 6	SO-2, PI 5 SO-2, PI 6
Business Presentation (Static Event)	Demonstrate the ability to develop a concept proposal and presenting it for support, (e.g., sponsor funding or other type(s) of support)	SO-2, PI 1 SO-2, PI 2	SO-2, PI 1 SO-2, PI 2
	Demonstrate the ability to provide sufficient information in an oral presentation to convince the audience to invest in the company. Presentation content includes: Unique value-added proposition and business need, vehicle design (consumer facing features specifically), manufacturing and supply chain, marketing, sales & distribution, aftermarket, and financials	SO-3, PI 1	SO-3, PI 1 SO-4, PI 5 SO-4, PI 6
	Display thorough knowledge and understanding of factors associated with promoting their product	SO-3, PI 1	SO-3, PI 1
	Demonstrate the ability to present in organized and effective ways: Thoughts are developed in a logical order of progress: transitions from thought to thought are clear and concise; distinct introduction and overviews as well as summary and conclusions are given; visual aids are used or clear visual references are made to the car	SO-3, PI 1	SO-3, PI 1

Acceleration, Traction, Maneuverability & Specialty Events (Dynamic Events)	Demonstrate the understanding of the vehicle's ability to come up to speed quickly from a standing start	SO-1, PI 1	SO-1, PI 1
	Demonstrate the understanding of the vehicle's relative ability to climb an incline from a standing start or pull a designated object (e.g., progressive weight skid, vehicle, or chain along a flat surface)	SO-1, PI 1	SO-1, PI 1
	Demonstrate the understanding of the vehicle's agility and handling ability over off-road terrain	SO-1, PI 1 SO-1, PI 2	SO-1, PI 1 SO-7, PI 1
	Demonstrate the understanding of the vehicle's ability to run under off-road conditions that might be specific to a particular Baja SAE competition site	SO-1, PI 1 SO-1, PI 2	SO-1, PI 1 SO-7, PI 1
Endurance (Dynamic Events)	Demonstrate the understanding of the vehicle's ability to operate continuously and at speed over rough terrain with obstacles in potentially adverse weather conditions (rain, snow, and others)	SO-1, PI 1 SO-1, PI 2	SO-1, PI 1 SO-7, PI 1
Project Management	Demonstrates the ability to organize into a Company structure with appropriate roles and responsibilities for each individual team member	SO-5, PI 3 PM-1, PM-2	SO-5, PI 3 SO-5, PI 5 SO-5, PI 6 SO-5, PI 7
	Demonstrates the ability to identify and apply strategies for organizing, staying on task, and completing the vehicle and other competition requirements (e.g., technical report, poster, presentation)	PM-1, PM-3	SO-5, PI 5 SO-5, PI 7
	Demonstrates the ability to create and track a budget (e.g., basic understanding of accounting)	PM-1, PM-3	SO-5, PI 5 SO-5, PI 7
	Demonstrates operational and organizational effectiveness via a task and time management plan	PM-1, PM-2 PM-3	SO-5, PI 5 SO-5, PI 6 SO-5, PI 7

Pilot Testing of Evaluate-Compete in an Engineering Technology Course

In the Fall 2023 semester, Evaluate-Compete (Version 1) was implemented in ENT 422, Machine Design II at SUNY Buffalo State University. Ten students were enrolled in this 3-credit hour course taken by students in Mechanical Engineering Technology. In this one semester course, the students design, build, test, present and prepare to compete in the Baja SAE competition. As in prior years, the current year's team start by reviewing the previous Baja team's design and performance and identify areas where the vehicle's performance was not optimal. Each member of the team is tasked with designing and testing vehicle components to improve the vehicle. To fabricate vehicle components the students use CAD and 2D and 3D modeling and spend significant time in the work bay designed especially to support the activities of the Baja team (Figure 1).

Figure 1. Baja car in the work bay

The implementation of E-Compete adhered to the sequence and timing of steps described earlier in this paper. During the first week of the 15-week course, students were introduced to the method by the course instructor, with the co-developer of E-Compete joining the orientation remotely. Following this introduction, students set up their password-protected accounts, completed the initial survey and answered the open-ended questions. These actions were completed during class time to ensure that these steps were completed by all students prior to the class conversation based on this initial pre-research assessment. The conversation, led by the team advisor, utilized the data automatically generated on the instructor's E-Compete dashboard page (e.g., the initial student average for the set of outcomes as shown in Table 6) as well as the responses students provided for the set of open-ended questions. Overall, the students recognized that the project demanded a range of theoretical and practical knowledge along with team work to solve problems. The students also indicated that they expected the project to be beneficial to their professional careers.

At about the middle of the semester, the next assessment was completed. The completion of the mid-research assessment took place after students had been working on the design and testing of the vehicle for ~2 months providing ample time for the team advisor to interact with the students such that they had a good understanding of the team's progress and individual student's contributions to the design of the vehicle. Similar to the initial assessment, the mid-point assessment was led by the team advisor and involved both a team conversation followed by individual conversations. In these conversations, students were encouraged to discuss what they identified as strengths and saw as areas where further improvements could be made. These conversations proved to be very useful in helping the students as they continued working on the vehicle in the second half of the semester.

The final (e.g., end-of-research) assessment and set of open-ended questions were completed in the final week of the semester. The timing of this was such that it allowed for a final class conversation and individual student conversations to share feedback based on the assessment and open-ended questions. These conversations were beneficial as it allowed all class members to reflect on the semester project to better understand their growth and contributions to the team's efforts and identify areas where perhaps they over-estimated their own and the team's abilities. Feedback from the students confirmed that they learned how to address unexpected problems or setbacks and taught them to be open-minded and listen to other people's ideas. The team advisor used team conversations to address general questions and concerns and discuss issues related to ordering parts, design/fabrication issues, and time management. The conversations with individual students allowed for praising an individual student's strengths and answering their particular questions and concerns. It also provided an opportunity to talk about any differences in instructor-assigned score and students' assigned scores to help the students realize the rationale for these differences.

Findings from Pilot Implementation of E-Compete

The average scores for the outcome categories for the initial, mid-point (midterm), and end-of-research (final) are shown in Table 6. The assessment results presented in this table are based on a five-point scale with 1=not yet displays the outcome, 2=seldom displays an outcome, 3=often displays an outcome, 4=usually displays an outcome, and 5=always displays an outcome. The scores documented in this table were assigned by the course instructor and are very similar to the scores students assigned themselves. The scores are not used for grading students, but effectively allow them to reflect on their strength and weaknesses, while engaged in learning activities.

While many of the outcome category scores increased over the semester, for some outcomes, the average final scores decreased. This pattern of decrease is the same pattern noted previously [1, 3] and is interpreted as reflecting the students' growing ability to more accurately self-assess their strengths and weaknesses, and their recognition that they do not know as much as they thought they did. This kind of intellectual development and growth is one of the benefits that arise from using E-Compete.

Table 6. Instructor Assessment Results of E-Compete General Outcomes

Evaluate-Compete Outcome Categories	Fall 2023			Spring 2024		
	Initial	Midterm	Final	Initial	Midterm	Final
	Student Average	Student Average	Student Average	Student Average	Student Average	Student Average
Communication	3.50	3.83	3.67	4.11	4.37	N/A
Creativity	2.97	3.57	3.57	4.26	4.53	N/A
Entrepreneurship	3.00	3.63	2.80	4.44	4.40	N/A
Autonomy	4.20	4.33	3.97	4.37	4.57	N/A
Ability to Deal with Obstacles	3.70	3.97	3.87	4.44	4.57	N/A
Intellectual Development	3.63	3.80	3.77	4.33	4.43	N/A
Critical Thinking and Problem Solving	3.33	3.60	3.40	4.26	4.47	N/A
Project Knowledge and Skills	3.10	3.33	3.47	3.81	4.30	N/A
Teamwork/Collaboration	4.47	4.47	4.53	4.81	4.77	N/A
Vehicle Components and Safety	3.45	3.50	3.50	3.94	4.30	N/A
Design Evaluation (Static Event)	3.13	3.43	2.90	3.59	3.93	N/A
Cost Evaluation (Static Event)	2.90	3.45	2.88	3.61	3.15	N/A
Business Presentation (Static Event)	2.68	3.23	2.70	3.53	3.65	N/A
Acceleration, Traction, Maneuverability & Specialty Events (Dynamic Events)	3.03	3.23	2.60	3.31	2.95	N/A
Endurance (Dynamic Events)	2.80	3.20	2.80	3.33	3.10	N/A
Project Management	3.08	3.75	3.28	3.83	3.95	N/A

Assessments of ETAC ABET student outcomes 1 – 5 were performed in the Machine Design II course using the Baja SAE competition-specific outcomes and corresponding PIs, as summarized in Table 5, three times during the Fall 2023 semester, and at the time of the paper submission, two times during the Spring 2024 semester. Unlike scores on the outcomes used in E-Compete, which are based on the frequency of the outcome component, the assessments of SOs 1 – 5 were performed by the course instructor in accordance with the grading rubrics introduced in [1]. The data are presented in Tables 7 – 11. The initial, midterm, and final averages are based on the following system: assessment score = (%Grade/10 + 5). For example, an assessment score of 3 = (80%/10 -5) and assessment score of 5 = (100%/10 – 5). Blanks in the tables indicate that the particular PI was not measured at the time of this paper submission.

As noted above for summary data in Table 6, some scores decreased over the semester. The course instructor can utilize the granular PIs to pin-point areas needing improvement. For example, SO 2, PI 4 in table 8 "Build a prototype/perform simulation, when it is impossible to build a prototype", clearly requires attention in continuous improvement process. SO 1, PI1 in Table 7 "Apply material from their discipline to the design of a project" calls for an action as assessed score of this PI is bordering the target for the outcome.

Table 7. Instructor Assessment of Subject Knowledge and Technical Merit

	Fall 2023			Spring 2024		
	Initial	Midterm	Final	Initial	Midterm	Final
Subject Knowledge and Technical Merit						
	Evaluate-Compete ABET Outcome 1					
Indicator	Student Average	Student Average	Student Average	Student Average	Student Average	Student Average
1	3.06	3.36	3.01	3.55	3.52	N/A
2	3.39	3.68	3.26	4.01	3.92	N/A
3						
4	3.23	3.50	3.13	3.74	4.10	N/A
Average	3.23	3.51	3.13	3.77	3.85	N/A
Target	3.00	3.00	3.00	3.00	3.00	3.00

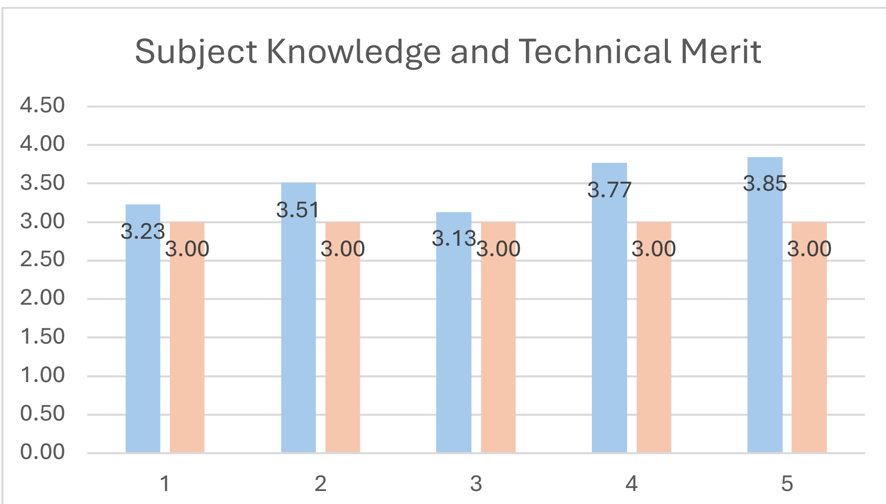


Table 8. Instructor Assessment of Design Capabilities

	Fall 2023			Spring 2024		
	Initial	Midterm	Final	Initial	Midterm	Final
Design Capabilities						
	Evaluate-Compete ABET Outcome 2					
Indicator	Student Average	Student Average	Student Average	Student Average	Student Average	Student Average
1	3.10	3.35	3.15	3.83	3.95	N/A
2	3.23	3.48	3.43	3.97	4.25	N/A
3	3.26	3.66	3.44	4.18	4.24	N/A
4	3.10	3.50	2.85	3.50	3.70	N/A
5	2.83	3.35	2.78	3.53	3.20	N/A
6	3.20	3.70	3.43	4.14	4.18	N/A
Average	3.12	3.51	3.18	3.86	3.92	N/A
Target	3.00	3.00	3.00	3.00	3.00	3.00

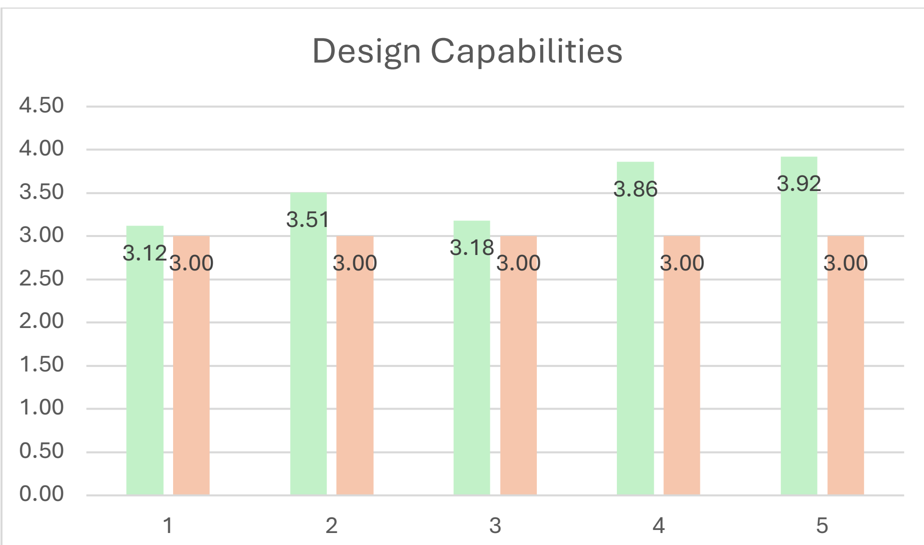


Table 9. Instructor Assessment of Communication Capabilities

	Fall 2023			Spring 2024		
	Initial	Midterm	Final	Initial	Midterm	Final
Communication Capabilities						
	Evaluate-Compete ABET Outcome 3					
Indicator	Student Average	Student Average	Student Average	Student Average	Student Average	Student Average
1	3.15	3.53	3.17	3.81	4.05	N/A
2	3.00	3.50	3.50	3.78	4.10	N/A
Average	3.08	3.52	3.33	3.80	4.08	N/A
Target	3.00	3.00	3.00	3.00	3.00	3.00

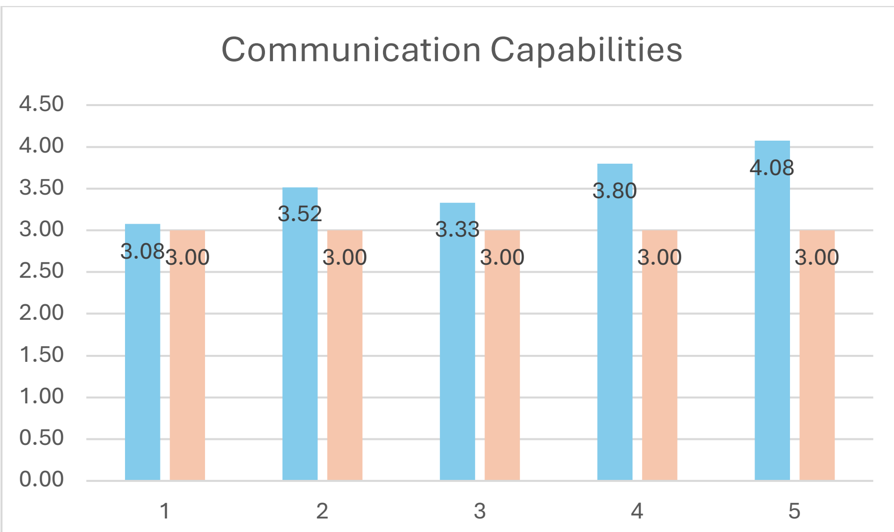


Table 10. Peer Assessment of Teamwork

	Fall 2023			Spring 2024		
	Initial	Midterm	Final	Initial	Midterm	Final
Teamwork (overall)						
	Evaluate-Compete ABET Outcome 5					
Indicator	Student Average	Student Average	Student Average	Student Average	Student Average	Student Average
1	3.80	3.90	3.80	4.33	4.50	N/A
2	4.50	4.55	4.55	4.83	4.75	N/A
3	3.60	3.95	3.80	4.33	4.35	N/A
4						
Average	3.97	4.13	4.05	4.50	4.53	N/A
Target	3.80	3.80	3.80	3.80	3.80	3.80

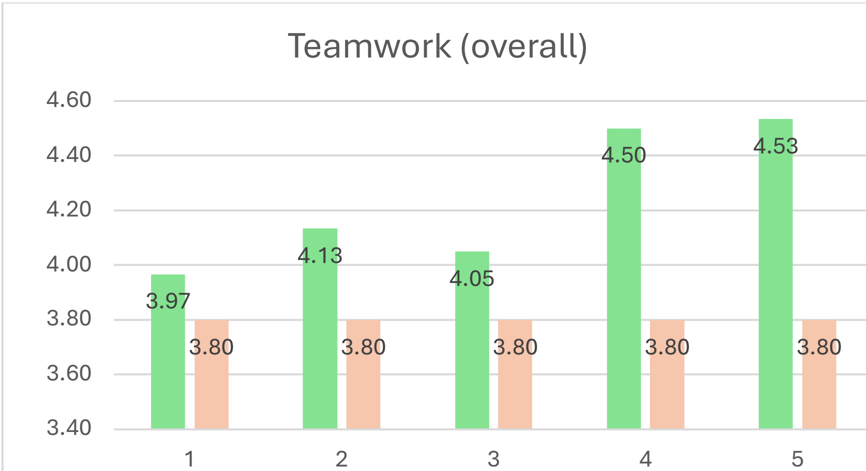
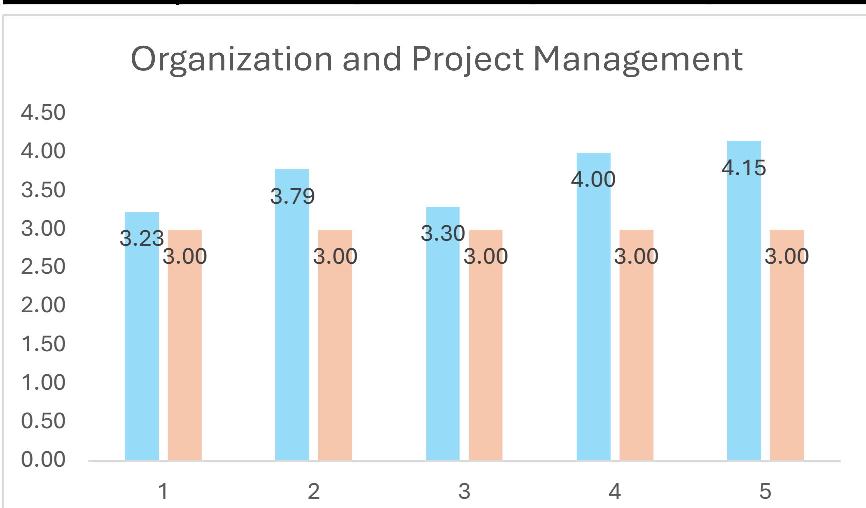


Table 11. Instructor Assessment of Organization and Project Management

	Fall 2023			Spring 2024		
	Initial	Midterm	Final	Initial	Midterm	Final
Organization and Project Management						
	Evaluate Compete ABET Criterion 5					
Indicator	Student Average	Student Average	Student Average	Student Average	Student Average	Student Average
1	3.08	3.72	3.14	3.96	4.04	N/A
2	3.47	3.87	3.53	4.04	4.33	N/A
3	3.15	3.78	3.23	4.00	4.08	N/A
Average	3.23	3.79	3.30	4.00	4.15	N/A
Target	3.00	3.00	3.00	3.00	3.00	3.00



Discussion

ETAC and EAC criteria state that effective assessment uses relevant direct, indirect, quantitative, and qualitative measures as appropriate to the outcome being measured. Furthermore, assessments that utilize rubrics or performance indicators are considered as primary or direct evidence. In E-Compete, students benefit from structured rubrics-based self-assessments and utilize timely feedback from the course instructor or team advisor following the assessments. These discussions help students gain confidence about their ability to accurately self-assess their strengths and weaknesses and contribute to improving their learning. E-Compete builds upon students' metacognitive skills using a set of general and competition-specific outcomes and complements and aligns with the performance indicators mapped to ETAC/EAC Criterion 3 Student Outcomes. Both E-Compete and ETAC/EAC student outcomes assessed following the performance indicators are considered direct evidence assessment approaches. The performance indicators and competition-specific outcome categories and defining components can be modified based on the particular program's educational objectives and the performance indicators defined therein are not limited to E-Compete and could be modified and used by other programs in assessing required student outcomes in Criterion 3. The pilot implementation in the capstone engineering technology course indicates that E-Compete could be valuable in providing students meaningful feedback while at the same time providing useful data for documenting student learning and continuous program improvement. Using E-Compete in conjunction with the student outcome performance indicators is beneficial to the program and allows areas needing improvement to be identified. Any substantial discrepancies between assessment results by two approaches call for a closer examination and identification for the reasons that might account for the differences. This reinforces the strength and desirability of multiple assessment tools.

Concluding Remarks

To serve the needs of engineering and engineering technology design courses and extracurricular projects, the EvaluateUR method introduced a new variant known as Evaluate-Compete (E-Compete). In addition to the list of general outcomes that are nearly identical to those used in EvaluateUR-CURE (E-CURE), E-Compete includes additional outcome categories that are based on the rubrics identified in competition manuals and rubrics used by the judges. The general and competition-specific outcomes have been mapped to EAC/ETAC SOs show how well-aligned the E-Compete outcomes are with the ABET Criterion 3. E-Compete can be successfully integrated into a one or two semester engineering/engineering technology course to support team/individual–team advisor conversations that are aimed at helping students understand their individual strengths as well as helping them become aware of situations when working with team members is essential for sharing knowledge and solving problems. While E-Compete directly benefits students, using the data automatically generated through its built-in data viewing option helps faculty and the program use these data to directly assess SOs using performance indicators. This in turn allows for the identification of areas where improvements are needed.

Acknowledgements

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Appendix 1

Alignment between Solar District Cup-specific Outcome Components and ETAC/EAC Performance Indicators

Solar District Cup Specific Outcome Cate	**Solar District Cup Specific Outcome Components**	**ETAC**	**EAC**
PV System Design	Demonstrate the ability to choose PV system locati and sizes that are appropriate for the district use cas context. Systems may include those on rooftops, building facades, ground mount, bodies of water (floating/aquavoltaic), agrivoltaic, or other options.	SO-1, rubric 1 SO-2, rubric 1 SO-2, rubric 3 SO-3, rubric 2 (Include references and codes and standards)	SO-1, rubric 1 SO-2, rubric 1 SO-2, rubric 3 SO-3, rubric 2 SO-4, rubric 6 SO-7, rubric 2 SO-7, rubric 3
	Demonstrate the ability to design an electrical layout for the PV system potentially including modules, strings, inverters, combiners and balance (system electrical components shown on a typical single-line diagram.	SO-1, rubric 1 SO-1, rubric 2 SO-2, rubric 1 SO-2, rubric 2	SO-1, rubric 1 SO-2, rubric 1 SO-2, rubric 2 SO-7, rubric 1
	Demonstrate the ability to describe mounting/anchoring approaches for the PV systems.	SO-2, rubric 1 SO-1, rubric 1	SO-2, rubric 1 SO-7, rubric 1
	Demonstrate the ability to compare and contrast the proposed PV system with typical practice and state-of-the-art	SO-2, rubric 3 SO-2, rubric 6 SO-1, rubric 2	SO-2, rubric 3 SO-2, rubric 6 SO-7, rubric 2
	Demonstrate the ability to model hourly (or similar time period) energy production from PV systems over the course of the year and to describe relationship to the customer load.	SO-1, rubric 1 SO-2, rubric 4 SO-2, rubric 5	SO-1, rubric 1 SO-2, rubric 4 SO-2, rubric 5 SO-6, rubric 2 SO-6, rubric 3 SO-6, rubric 4
Storage Design	Demonstrate the ability to identify appropriate storage technologies for the proposed design with respect to the customer load, electricity tariff, PV generation, cost and other considerations.	SO-1, rubric 1 SO-1, rubric 2 SO-2, rubric 2	SO-1, rubric 1 SO-2, rubric 2 SO-7, rubric 1 SO-7, rubric 2 SO-7, rubric 3
	Demonstrate the ability to design appropriately sized storage system(s) for the application context	SO-1, rubric 1 SO-2, rubric 1 SO-2, rubric 2	SO-1, rubric 1 SO-2, rubric 1 SO-2, rubric 2
	Demonstrate the ability to model hourly (or similar time period) dispatch of the storage solution over the course of the year from technical and financial perspectives	SO-2, rubric 4	SO-2, rubric 4 SO-6, rubric 2 SO-6, rubric 3
Distribution System Impacts	Demonstrate the ability to describe constraints and hosting capacity of the distribution network local to the district use case	SO-2, rubric 1	SO-2, rubric 1
	Demonstrate the ability to design and describe	SO-2, rubric 1	SO-2, rubric 1 SO-2, rubric 2

	suitable interconnection approaches for the proposed system (including storage if applicable).	SO-2, rubric 2	
	Demonstrate the ability to describe potential impacts of the proposed design on operation and reliability of the local distribution network.	SO-2, rubric 6 SO-3, rubric 1	SO-2, rubric 6 SO-3, rubric 1 SO-4, rubric 5 SO-4, rubric 6
Financial Model	Demonstrate an understanding of the different types of common financing approaches used in solar energy (e.g. PPA, lease, etc).	SO-1, rubric 2 SO-3, rubric 2	SO-7, rubric 1 SO-7, rubric 2
	Demonstrate an ability to analyze lifetime financial performance of the proposed design in the context of both the developer/investor and the offtaker/customer using realistic assumptions and tariff data	SO-1, rubric 1 SO-2, rubric 5	SO-1, rubric 1 SO-2, rubric 5 SO-4, rubric 5
District Use Case Analysis	Demonstrate the ability to formulate design constraints and performance criteria that align with the client's needs and goals as described in the district master plan.	SO-2, rubric 1 SO-2, rubric 2	SO-2, rubric 1 SO-2, rubric 2 SO-4, rubric 3 SO-4, rubric 5 SO-4, rubric 6
	Demonstrate the ability to describe the proposed design's alignment with design constraints and performance criteria and their coherence with the district master plan.	SO-2, rubric 1 SO-2, rubric 2 SO-2, rubric 7	SO-2, rubric 1 SO-2, rubric 2 SO-4, rubric 5 SO-2, rubric 7
	Demonstrate the ability to choose appropriate tools to model the proposed design's: •Solar energy production •Generation, Storage and Load energy flows •Financial performance	SO-1, rubric 1, SO-2, rubric 4	SO-1, rubric 1, SO-2, rubric 4 SO-6, rubric 1
Development Plan	Demonstrate an ability to identify applicable Authorities Having Jurisdiction (AHJs) for the district use case	SO-1, rubric 2,	SO-7, rubric 1 SO-7, rubric 2
	Demonstrate the ability to describe the proposed design's compliance with relevant: •Engineering standards •Laws and regulations (including permitting requirements) •Building codes	SO-2, rubric 1 SO-3, rubric 2	SO-2, rubric 1 SO-4, rubric 4 SO-4, rubric 6 SO-7, rubric 2
	Demonstrate the ability to define a realistic constru plan and timeline	PM-3	SO-5, rubric 7
Distributional Energy Equity Analysis	Demonstrate the ability to identify relevant stakeholders who may be impacted by the proposed design.	SO-1, rubric 2,	SO-7, rubric 2 SO-4, rubric 5
	Demonstrate the ability to describe potential impacts of a design on impacted stakeholders from perspective of equity. Considerations may include: •Access •Affordability		SO-4, rubric1 SO-4, rubric 3 SO-4, rubric 4 SO-4, rubric 5 SO-4, rubric 6

	•Service reliability •Disaster response and management •Broader contexts		
	Demonstrate the ability to propose approaches that mitigate distributional energy equity impacts of the design	SO-2, rubric 6	SO-2, rubric 6 SO-4, rubric 1 SO-4, rubric 2 SO-4, rubric 6
Written Report and Presentation	Demonstrate an ability to produce a report that follows the specification laid out in the competition rules document. This includes the ability to: •Follow all length, format and time requirements •Include all requested information •Write professionally using proper spelling and grammar •Create document with consistent, professional formatting and style •Correctly cite relevant sources used	SO-3, rubric 1 SO-3, rubric 2	SO-3, rubric 1 SO-3, rubric 2 SO-7, rubric 2
	Demonstrate the ability to create an effective Executive Summary of the proposed design	SO-3, rubric 1	SO-3, rubric 1
	Demonstrate the ability to present and write in a professional, organized and effective manner: •Thoughts are presented in a logical order of progress •Transitions from thought to thought are clear and concise •Distinct introduction and overviews as well as summary and conclusions are given •Visual aids are used or clear visual references are made to the design	SO-3, rubric 1	SO-3, rubric 1
Project Management and Teamwork	Demonstrate the ability to self-organize with appropriate roles and responsibilities for each individual team member	SO-5, rubric 4	SO-5, rubric 4
	Demonstrate the ability to identify and apply strategies for organizing, staying on task, and completing the design and other competition requirements (e.g., deliverable package, and presentation)	SO-3, rubric 1 PM-1, PM-3	SO-3, rubric 1 SO-5, rubric 5 SO-5, rubric 7
	Demonstrate the ability to effectively incorporate contributions from individual members to a single final product	SO-5, rubric 1 SO-5, rubric 2 SO-5, rubric 3	SO-5, rubric 1 SO-5, rubric 2 SO-5, rubric 3
	Demonstrate operational and organizational effectiveness via a task and time management plan	PM-1, PM-2, PM-3	SO-5, rubric 5 SO-5, rubric 6 SO-5, rubric 7

Appendix 2

Alignment between MATE's ROV-specific Outcome Components and ETAC/EAC Performance Indicators

MATE's ROV-specific Outcome Categories	MATE's ROV-specific Outcome Components	ETAC	EAC
Vehicle Design, Buoyancy, and Propulsion	Displays knowledge and demonstrates application of buoyancy principles to vehicle design/buoyancy/ballast	SO-1, rubric 1 SO-3, rubric 2 (include references and codes and standards)	SO-1, rubric 1 SO-3, rubric 2
	Displays knowledge of the physical properties of water (e.g. increased pressure with depth) and applies that knowledge to vehicle/system design, principles to vehicle design/buoyancy/ballast	SO-1, rubric 1 SO-1, rubric 4	SO-1, rubric 1 SO-1, rubric 4
	Displays knowledge of the principles of hydrodynamics/Newton's Laws of Motion and the application of those principles to vehicle design/propulsion	SO-1, rubric 1 SO-1, rubric 4	SO-1, rubric 1 SO-1, rubric 4
Systems Design	Demonstrates an understanding of relevant engineering principles and the application of those principles to the design of the vehicle systems	SO-1, rubric 1 SO-1, rubric 2	SO-1, rubric 1 SO-7, rubric 1
Structure	Demonstrates the ability to analyze and describe trade-offs and rationale for vehicle cost, size, and weight	SO-2, rubric 2	SO-2, rubric 2
Control/Electrical	Demonstrates an understanding of electrical concepts and the application of those concepts to vehicle control/electrical system	SO-1, rubric 1	SO-1, rubric 1
	Demonstrates the ability to integrate software and electronics into the vehicle control systems	SO-1, rubric 1	SO-1, rubric 1
Sensors/Payload/Tools	Displays knowledge of sensors and tooling and the ability to identify and evaluate sensors and tooling (including cameras) to meet competition mission requirements	SO-1, rubric 1	SO-1, rubric 1
	Displays knowledge of computer science/programming and the application of that knowledge to control/sensor systems	SO-1, rubric 1	SO-1, rubric 1
Safety	Understands and applies safety principles to personnel, equipment and operations	SO-2, rubric 1 SO-2, rubric 2	SO-2, rubric 1 SO-2, rubric 2
Project Management	Demonstrates the ability to organize into a company structure with appropriate roles and responsibilities for each individual team member	SO-5, rubric 3 PM-1, PM-2	SO-5, rubric 3
	Demonstrates the ability to identify and apply strategies for organizing, staying on task, and completing the vehicle and other competition	PM-1, PM-3 SO-3, rubric 1	SO-5, rubric 5 SO-5, rubric 7 SO-3, rubric 1

	requirements (e.g., technical report, poster, presentation)		
	Demonstrates the ability to create and track a budget (e.g., basic understanding of accounting)	PM-1, PM-3	SO-5, rubric 5 SO-5, rubric 7
	Demonstrates operational and organizational effectiveness via a task and time management plan	PM-3	SO-5, rubric 7
Technical Presentation	Demonstrates the ability to develop detailed documentation	SO-3, rubric 1	SO-3, rubric 1
	Demonstrates the ability to present relevant documentation to support the ROV design	SO-3, rubric 1	SO-3, rubric 1
	Displays the ability to create a marketing display that clearly explains the ROV design	SO-3, rubric 1	SO-3, rubric 1
	Demonstrates the ability to explain the benefits and weaknesses of the ROV design	SO-2, rubric 6 SO-3, rubric 1	SO-2, rubric 6 SO-3, rubric 1
Technology and Society	Understands how the competition theme(s) relate to real-world issues	SO-2, rubric 1 SO-2, rubric 2	SO-2, rubric 1 SO-2, rubric 2 SO-4, rubric 5
	Understands how solving specific mission tasks relates to addressing real-world technical problems	SO-2, rubric 1 SO-2, rubric 2	SO-2, rubric 2
	Demonstrates an awareness of environmental, societal, and governance (ESG) factors and how organizations and corporations are taking these into consideration when making decisions about business and workplace practices	SO-2, rubric 1 SO-2, rubric 2	SO-2, rubric 1 SO-2, rubric 2 SO-4, rubric 6