

# EvaluateUR, EvaluateUR-CURE, and Evaluate-Compete: Methods for Evaluating Outcomes in Independent Research, Course-based Undergraduate Research Experiences, and Remotely Operated Vehicle Competitions

Jill Singer, SUNY Buffalo State [singerjk@buffalostate.edu](mailto:singerjk@buffalostate.edu)

Providing undergraduates opportunities to conduct research brings a broad range of desirable outcomes including content knowledge, and also outcomes important in the workplace, such as communication skills, creativity, autonomy, ability to overcome obstacles, critical thinking, and problem-solving skills. EvaluateUR was built upon and expanded the Buffalo State Office of Undergraduate Research's summer research program evaluation method initially developed in 2008. With funding from the National Science Foundation, EvaluateUR has been scaled up to serve colleges and universities across the U.S. EvaluateUR provides statistically reliable assessments of student growth in 11 outcome categories using a rubric that describes the specific student behaviors measured by each outcome category, for a total of 35 outcome components. Students score themselves on each component, and their research mentors, using the same instrument, also independently score their students. EvaluateUR stresses that the scores are less important than the conversations that follow the assessments, at which time the student and mentor share their rationales for assigning particular scores and discuss any differences. These conversations are key to the development of student metacognitive skills, as they provide opportunities for students to reflect on their strengths and weaknesses, assess the value of the learning strategies they have been employing, and consider what adjustments in substantive focus and/or learning strategies they should make in order to improve their outcomes. With a National Science Foundation Advanced Technological Education award made in 2018, EvaluateUR is being modified to support Course-based Undergraduate Research Experiences (CUREs). By integrating research into undergraduate courses, CUREs provide research opportunities for students who might not otherwise engage in this valuable learning activity. With an additional award from the NSF ATE program made in 2019 to Jill Zande, MATE Center and Jill Singer, SUNY Buffalo State, EvaluateUR is informing the development of Evaluate-Compete. Evaluate-Compete will be designed to help high school, community college, and college/university students who participate in ROV (remotely underwater vehicle) competitions to identify the knowledge and skills they need to gain through this activity, to see clearly the areas where they need to improve, and to use this knowledge to their advantage as they continue their education and/or prepare to enter the workforce. Evaluate-Compete will also support faculty advisors as they mentor students who are designing and building ROVs, and provide valuable feedback to MATE about the academic value of the competitions.

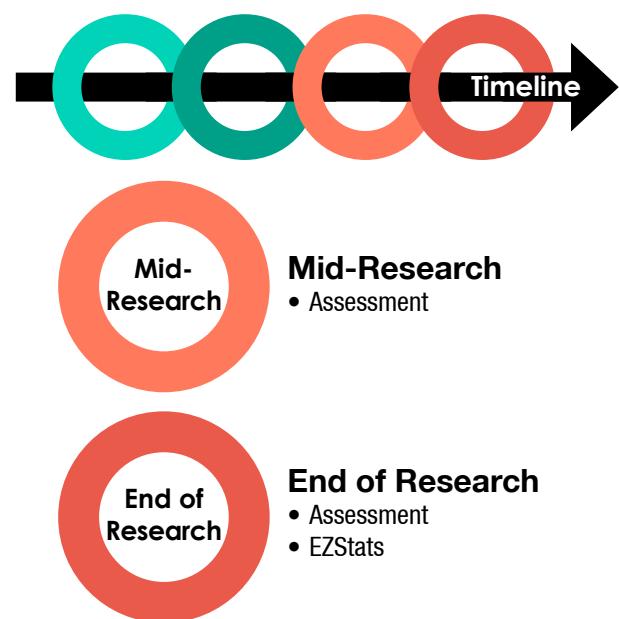
## Metacognition and EvaluateUR, EvaluateUR-CURE, and Evaluate-Compete Approaches

The AAC&U asserts that "the central theme of any curriculum should be to teach students how to learn." This process, called metacognition, is characterized by an awareness of one's own thinking and a willingness to make adjustments based on that awareness (Scharff et al., 2017). Metacognition encourages learners to be aware of what they are doing and why (self-monitoring) and then use that awareness to make intentional adjustments to their learning strategies (self-regulation) to learn more effectively. EvaluateUR, EvaluateUR-CURE, and Evaluate-Compete all address the need to introduce undergraduates conducting research to a broad range of desirable outcomes that include but go beyond content knowledge, particularly outcomes that are critically important in the workplace, such as communication skills, creativity, autonomy, ability to overcome obstacles, critical thinking, and problem-solving skills. EvaluateUR, EvaluateUR-CURE, and Evaluate-Compete are designed to help develop students' metacognitive skills as well as a way to see how much academic progress they have made or still need to make.

Project Website: <https://serc.carleton.edu/evaluateur>

## EvaluateUR Sequence of Steps

The website (<https://serc.carleton.edu/evaluateur/roadmap>) explains all the steps required to successfully implement EvaluateUR. The information is organized into the four sections shown below, and there are resources to assist you. The term 'site administrator' refers to the person responsible for implementing EvaluateUR and could be an undergraduate research director or coordinator or the Principal Investigator of an NSF REU site (or other undergraduate research program.)



EvaluateUR is supported by the WIDER program under Grant Number 1347681. EvaluateUR-CURE is supported by the ATE program under Grant Number 1347727. Evaluate-Compete is supported by the Advanced Technological Education program under Grant Numbers 1932929 and 1932940. Any opinions, findings, and conclusions or recommendations expressed are those of the author and do not necessarily reflect the views of the NSF.

## Interested in Receiving Updates?

Sign up for periodic updates and information about these projects.

[https://serc.carleton.edu/evaluateur/community/contact\\_us.html](https://serc.carleton.edu/evaluateur/community/contact_us.html)

<b>Outcome Categories</b>	<b>EvaluateUR: Outcome Components</b>	<b>EvaluateUR-CURE: Outcome Components</b>
<b>Communication</b>	<ul style="list-style-type: none"> <li>Understands and uses discipline-specific language</li> <li>Expresses ideas orally in an organized, clear, and concise manner</li> <li>Writes clearly and concisely using correct grammar, spelling, syntax, and sentence structure</li> </ul>	<ul style="list-style-type: none"> <li>Uses and understands professional and discipline-specific language.</li> <li>Expresses ideas orally in an organized, clear, and concise manner.</li> <li>Writes clearly and concisely using correct grammar, spelling, syntax, and sentence structure.</li> </ul>
<b>Creativity</b>	<ul style="list-style-type: none"> <li>Displays insight about the topic being investigated</li> <li>Shows ability to approach problems from different perspectives</li> <li>Uses information in ways that demonstrate intellectual resourcefulness</li> <li>Effectively connects multiple ideas/approaches</li> </ul>	<ul style="list-style-type: none"> <li>Shows ability to approach problems from different perspectives</li> <li>Uses information in ways that demonstrate intellectual resourcefulness</li> <li>Effectively connects multiple ideas/approaches</li> </ul>
<b>Autonomy</b>	<ul style="list-style-type: none"> <li>Demonstrates an ability to work independently and identify when guidance is needed</li> <li>Accepts constructive criticism and uses feedback effectively</li> <li>Uses time well to ensure work gets accomplished</li> <li>Sets and meets project deadlines</li> </ul>	<ul style="list-style-type: none"> <li>Demonstrates an ability to work independently and identify when guidance is needed</li> <li>Accepts constructive criticism and uses feedback effectively.</li> <li>Uses time well to ensure work gets accomplished</li> </ul>
<b>Ability to Deal with Obstacles</b>	<ul style="list-style-type: none"> <li>Is not discouraged by unforeseen problems and perseveres when encountering challenges or setbacks</li> <li>Shows flexibility and a willingness to take risks and try again</li> <li>Trouble-shoots problems and searches for ways to do things more effectively</li> </ul>	<ul style="list-style-type: none"> <li>Is not discouraged by setbacks or unforeseen problems and perseveres when encountering challenges or setbacks.</li> <li>Shows flexibility and a willingness to take risks and try again.</li> <li>Trouble-shoots problems and searches for ways to do things more effectively.</li> </ul>
<b>Intellectual Development</b>	<ul style="list-style-type: none"> <li>Recognizes that problems are often more complicated than they first appear</li> <li>Approaches problems with an understanding that there can be more than one right explanation or even none at all</li> <li>Displays accurate insight into the limits of his/her own knowledge and an appreciation for what isn't known</li> </ul>	<ul style="list-style-type: none"> <li>Recognizes that problems are often more complicated than they first appear.</li> <li>Approaches problems with an understanding that there can be more than one right explanation or even none at all</li> <li>Displays insight into the limits of his or her knowledge and an appreciation for what isn't known.</li> </ul>
<b>Critical Thinking and Problem Solving</b>	<ul style="list-style-type: none"> <li>Challenges established thinking when appropriate</li> <li>Looks for the root causes of problems and develops or recognizes the most appropriate corrective actions</li> <li>Recognizes flaws, assumptions and missing elements in arguments</li> </ul>	<ul style="list-style-type: none"> <li>Maintains a posture of open-minded skepticism when considering potential solutions to problems.</li> <li>Looks for the root causes of problems and develops or recognizes the most appropriate corrective actions</li> <li>Recognizes flaws, assumptions and missing elements in arguments</li> </ul>
<b>Practice and Process of Inquiry</b>	<ul style="list-style-type: none"> <li>Demonstrates ability to formulate questions and hypotheses within the discipline</li> <li>Demonstrates ability to properly identify and/or generate reliable data</li> <li>Shows understanding of how knowledge is generated, validated and communicated within the discipline</li> </ul>	<ul style="list-style-type: none"> <li>Demonstrates ability to formulate questions within the discipline.</li> <li>Demonstrates ability to properly identify and/or generate reliable data.</li> <li>Shows understanding of how knowledge is generated, validated and communicated within the discipline</li> </ul>
<b>Nature of Disciplinary Knowledge</b>	<ul style="list-style-type: none"> <li>Shows understanding of the way practitioners think within the discipline and view the world around them</li> <li>Shows understanding of the criteria for determining what is valued as a contribution in the discipline</li> <li>Shows awareness of important contributions in the discipline and who was responsible for those contributions</li> <li>Reads and applies information obtained from professional journals and other sources</li> <li>Is aware of professional societies in the discipline</li> </ul>	<ul style="list-style-type: none"> <li>Shows understanding of the criteria for determining what is valued as a contribution in the discipline</li> <li>Shows awareness of important contributions in the discipline and who was responsible for those contributions</li> <li>Reads and applies information obtained from professional journals and other sources</li> </ul>
<b>Content Knowledge and Methods</b>	<ul style="list-style-type: none"> <li>Displays knowledge of key facts and concepts</li> <li>Displays a grasp of relevant research methods and is clear about how these methods apply to the research project being undertaken</li> <li>Demonstrates an appropriate mastery of skills needed to conduct the project</li> </ul>	<ul style="list-style-type: none"> <li>Displays knowledge of key facts and concepts relevant to project</li> <li>Displays a grasp of relevant methods and is clear about how these methods apply to the project being undertaken</li> <li>Demonstrates an appropriate mastery of skills needed to conduct the project</li> </ul>
<b>Ethical Conduct</b>	<ul style="list-style-type: none"> <li>Recognizes that it is unethical to create, modify, misrepresent, omit, eliminate or misreport data or findings, or to misrepresent authorship</li> <li>Behaves with a high level of collegiality and treats others with respect</li> </ul>	<ul style="list-style-type: none"> <li>This outcome category is covered by an open-ended question on an assignment completed by the student at the beginning of the research experience.</li> </ul>
<b>Career Goals</b>	<ul style="list-style-type: none"> <li>Is clear about academic and/or professional/work plans</li> <li>Is aware of how research skills relate to academic and/or professional/work plans</li> </ul>	<ul style="list-style-type: none"> <li>This outcome category is covered by an open-ended question on an assignment completed by the student at the beginning of the research experience.</li> </ul>
<b>Teamwork/Collaboration</b>	<ul style="list-style-type: none"> <li>This outcome is not applicable to independent research conducted by a student.</li> </ul>	<ul style="list-style-type: none"> <li>Demonstrates ability to manage conflict among colleagues</li> <li>Displays ability to share distribution of tasks</li> <li>Shows ability to work effectively in a team</li> </ul>