## PERFORMANCE-BASED ASSESSMENT GUIDE

Performance-based Assessment

While standardized tests are the hallmark of school assessment, because they are inexpensive and easy to administer, they are less than a perfect fit for a course like this one. While standardized tests are effective at measuring factual and contextual knowledge, they are largely ineffective in measuring students' skills or ability to apply concepts. Performance-based assessment techniques provide the teacher with a better tool for measuring both student understanding and ability.

Performance-based assessments allow for the student to be evaluated against a set of previously identified criteria while performing a task reflective of the intended learning. Performance-based assessment provides the teacher with information about how a student understands and whether the student can apply the newly gained knowledge. These assessments are often used to evaluate student application, performance, values, skills, and abilities against a given criteria. By their nature, performance-based assessments require the student to use higher-order thinking skills than do traditional standardized tests. Performance-based assessment is best suited for measuring student cognitive application and psychomotor ability. For example, performance-based assessment is very well suited for use during oral presentations, while working as a member of a team, while operating a piece of equipment, or while defending an action.

How is student performance measured?

Student performance is best measured using performance criteria. By creating performance criteria upfront (prior to the test) and sharing that information early, students understand exactly what will be expected of them on the performance test. Additionally, these criteria allow the instructor and student to evaluate the task as objectively as possible. The measure of well-designed performance criteria is criteria that would allow a substitute instructor to evaluate the student performance as accurately as the person who developed the performance criteria.

Four tools for performance-based assessment:

* Rubric: A rubric is a rating scale that shows to what degree a criterion is met. Most rubrics use a three to five column scale that allows the teacher to indicate whether the criteria were "not met" to “superior."
* Checklist: A checklist is a simpler version of a rubric and usually documents only whether or not certain criteria were met during the task.
* Portfolio: A portfolio is a graphic record of projects and activities completed by the student over a given period of time that illustrates how well a student has met the performance criteria.
* Project: A project is a tangible item that can be assessed based on performance criteria established at the beginning of the project assignment.

The following are examples of project rubrics.

**Rubric**

Name: Teammate Name/s:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Approaching Target**  **Points: \_\_\_\_\_\_\_** | **On Target**  **Points: \_\_\_\_\_\_\_** | **Bullseye**  **Points: \_\_\_\_\_\_\_** | **Total**  **Points** |
| **Engineering Design Process** | Student is developing an understanding of the steps within the engineering design process. | Student demonstrates knowledge of the engineering design process. | Student understands and utilizes the engineering design process to advance his or her learning. |  |
| **Understanding** | Student work lacks understanding of concepts and skills. | Student work shows some understanding of concepts and skills. | Student work shows a mastery of skills and reflects a deep understanding of concepts. |  |
| **Materials and Resources** | Student inconsistently uses materials and resources to demonstrate understanding. | Student is developing skills to use materials and resources for a purpose. | Student skillfully uses materials and resources with ease and models use for others. |  |
| **Craftsmanship** | Work is messy and detracts from the overall presentation. | Work is neat and shows thoughtfulness. | Work demonstrates care and precision. |  |
| **Effort** | Student puts forth some effort but may require assistance to persevere on tasks. | Student puts forth an effort and completes tasks with success. | Student demonstrates strong efforts and encourages others to do the same. |  |
| **Reflection** | Reflection is not a natural process for the student and he or she requires facilitation from the teacher or peers to reflect on his or her learning. | Student reflects on his or her work and can communicate this through writing or discussion. | Student provides ongoing consideration to his or her literacy learning and models reflective thinking and language for others. |  |
| **Total:**  **Comments:** | | | | |

**Team Performance Rubric**

Name: Teammate Name/s:

The following rubric is designed to be used to assess student performance when working in teams.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Category** | Up to 5 pts. | Up to 10 pts. | Up to 15 pts. | Up to 20 pts. | Score |
|  | Unacceptable Level Performance | Intermediate Level Performance | Accomplished  Level Performance | Superior Level Performance |  |
| **Responsibility:** My teammate contributed at least 50% of the effort and helped us finish the task. |  |  |  |  |  |
| **Contribution:** My teammate contributed to the success of the team, completed his/her share of the work, and offered constructive feedback to complete the tasks. |  |  |  |  |  |
| **Team Performance:**  My team completed the task or finished a project accurately, on time, & according to specifications because all members contributed. |  |  |  |  |  |
| **Team Collaboration:**  The team functioned at a high level—with all members carrying out specific roles and contributing equally. |  |  |  |  |  |
| **Communication:**  My teammate contributed to an effective team output, presentation, or communication of effort. |  |  |  |  |  |
| Comments:  Total Points: | | | | | |

## TEAM PERFORMANCE RUBRIC

The following rubric is designed to be used to assess student performance in teams.

|  |
| --- |
| Student Name: |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Instructions:** *Using the right-hand columns, mark the highest level achieved in each category.*  Criteria:  20 = Superior Level Performance 15 = Accomplished Level Performance 10 = Intermediate Level Performance   5 = Beginning Level Performance   0 = Unacceptable Level of Performance |  |  |  |  |  | **T**  **O**  **T**  **A**  **L** |
| **Individual Responsibility: *Contributed to the team and helped others in the group when finished with*** *their own tasks.* | **20** | **15** | **10** | **5** | **0** |  |
| **Individual Contribution:** Contributed to the success of the team and *offered constructive feedback to other members during completion of team tasks.* | **20** | **15** | **10** | **5** | **0** |  |
| **Team Performance:** The team completed a task or finished a project accurately, on time, & according to specifications. | **20** | **15** | **10** | **5** | **0** |  |
| **Team Function/Collaboration:** The team functioned at a high level—with all members carrying out specific roles and contributing equally. | **20** | **15** | **10** | **5** | **0** |  |
| **Team Communication/Presentation:** Each member of the team contributed to an effective team output, presentation, or communication of effort. | **20** | **15** | **10** | **5** | **0** |  |
| **TOTAL POINTS** |  |  |  |  |  |  |

## 

## ORAL PRESENTATION RUBRIC

The following rubric is designed to be used to assess student presentation performance.

|  |
| --- |
| Student Name: |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Instructions:** *Using the right-hand columns, mark the highest level achieved in each category.*  Criteria:  20 = Superior Level Performance 15 = Accomplished Level Performance 10 = Intermediate Level Performance   5 = Beginning Level Performance   0 = Unacceptable Level of Performance |  |  |  |  |  | **T**  **O**  **T**  **A**  **L** |
| **Organization: *Presentation was organized in a logical, coherent, and interesting sequence which the audience could follow.*** | **20** | **15** | **10** | **5** | **0** |  |
| **Depth of Coverage:** Presentation demonstrated a full knowledge of the subject, and included explanations and elaboration—when appropriate. | **20** | **15** | **10** | **5** | **0** |  |
| **Mechanics:** Presentation was free of errors, misstatements, misspellings, or grammatical errors. | **20** | **15** | **10** | **5** | **0** |  |
| **Communication Aids:** Communication aids were clear, useful, and helped to explain or reinforce the content or idea. | **20** | **15** | **10** | **5** | **0** |  |
| **Effectiveness:** Presentation was effective. The intended message was clearly delivered through the presentation. | **20** | **15** | **10** | **5** | **0** |  |
| **TOTAL POINTS** |  |  |  |  |  |  |

## WRITING RUBRIC

The following rubric is designed to be used to assess student presentation performance.

|  |
| --- |
| Student Name: |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Instructions:** *Using the right-hand columns, mark the highest level achieved in each category.*  Criteria:  20 = Superior Level Performance 15 = Accomplished Level Performance 10 = Intermediate Level Performance   5 = Beginning Level Performance   0 = Unacceptable Level of Performance |  |  |  |  |  | **T**  **O**  **T**  **A**  **L** |
| **Content/Ideas: *Writing is purposeful, confident, and clearly focused. It holds the reader's attention and includes relevant details and technical details when needed.*** | **20** | **15** | **10** | **5** | **0** |  |
| **Organization:** Writing includes a strong beginning, middle, and end with clear transitions and a focused closure. | **20** | **15** | **10** | **5** | **0** |  |
| **Mechanics:** Written work was free of errors, vocabulary errors, misspellings, or grammatical errors and included effective and engaging use of word choice. | **20** | **15** | **10** | **5** | **0** |  |
| **Sentence Fluency: *Consistent variety of sentence structure throughout***. | **20** | **15** | **10** | **5** | **0** |  |
| **Content Knowledge: *Demonstrates a thorough knowledge of the subject matter***. The intended message was clearly delivered through the written work. | **20** | **15** | **10** | **5** | **0** |  |
| **TOTAL POINTS** |  |  |  |  |  |  |

## FIELD TRIP/TOUR RUBRIC

The following rubric is designed to be used to assess student performance after completing a field trip or tour.

|  |
| --- |
| Student Name: |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Instructions:** *Using the right-hand columns, mark the highest level achieved in each category.*  Criteria:  20 = Superior Level Performance 15 = Accomplished Level Performance 10 = Intermediate Level Performance   5 = Beginning Level Performance   0 = Unacceptable Level of Performance |  |  |  |  |  | **T**  **O**  **T**  **A**  **L** |
| **Field Trip/Tour Notes:** *The notes are complete, accurate, based on the fieldtrip and class discussion, and or****ganized in a logical, coherent, and interesting sequence.*** | **20** | **15** | **10** | **5** | **0** |  |
| **Written Report:** *The written field trip/tour report was fact-based and contained no grammatical, capitalization, punctuation, or spelling errors.* | **20** | **15** | **10** | **5** | **0** |  |
| **Power Point Presentation:** *The created Power Point presentation was based on a written report and included at least one picture from clip art, slide transitions, preset animation for each bullet, and a total of six slides.* | **20** | **15** | **10** | **5** | **0** |  |
| **Oral Presentation:** *The oral presentation was enthusiastic and presented to the instructor and peers with a strong clear voice. Speaking at an understandable rate.* | **20** | **15** | **10** | **5** | **0** |  |
| **Effectiveness:** Presentation was effective. The intended message was clearly delivered through the presentation. | **20** | **15** | **10** | **5** | **0** |  |
| **TOTAL POINTS** |  |  |  |  |  |  |

## EQUIPMENT OPERATION PERFORMANCE RUBRIC

The following rubric is designed to be used to assess student performance when operating tools, machinery, and equipment.

|  |
| --- |
| Student Name: |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Instructions:** *Using the right-hand columns, mark the highest level achieved in each category and then calculate the total score.*  Criteria:  20 = Superior Level Performance 15 = Accomplished Level Performance 10 = Intermediate Level Performance   5 = Beginning Level Performance   0 = Unacceptable Level of Performance |  |  |  |  |  | **T**  **O**  **T**  **A**  **L** |
| **Safety:** Demonstrated knowledge of appropriate safety practices and practiced using safe operating procedures. | **20** | **15** | **10** | **5** | **0** |  |
| **Quality:** Produced products and projects of high quality while completing assigned tasks. | **20** | **15** | **10** | **5** | **0** |  |
| **Accuracy:** Accurately completed assigned tasks within timeframes established by the instructor. | **20** | **15** | **10** | **5** | **0** |  |
| **Operational Procedures:** Demonstrated accurate and appropriate use of the machine, tool, or process. | **20** | **15** | **10** | **5** | **0** |  |
| **Craftsmanship:** Exhibited a level of craftsmanship expected of accomplished professionals in this area. | **20** | **15** | **10** | **5** | **0** |  |
| **TOTAL POINTS** |  |  |  |  |  |  |

## PROBLEM SOLVING PERFORMANCE RUBRIC

The following rubric is designed to be used to assess student performance when solving problems and case studies related to engineering and technology education.

|  |
| --- |
| Student Name: |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Instructions:** *Using the right-hand columns, mark the highest level achieved in each category and then calculate the total score.*  Criteria:  20 = Superior Level Performance 15 = Accomplished Level Performance 10 = Intermediate Level Performance   5 = Beginning Level Performance   0 = Unacceptable Level of Performance |  |  |  |  |  | **T**  **O**  **T**  **A**  **L** |
| **Function:** Does the solution meet original parameters and does it perform the intended function appropriately? | **20** | **15** | **10** | **5** | **0** |  |
| **Quality:** Does the completed solution meet or exceed written or implied standards. | **20** | **15** | **10** | **5** | **0** |  |
| **Accuracy:** Accurately completed assigned tasks associated with the problem within timeframes established by the instructor. | **20** | **15** | **10** | **5** | **0** |  |
| **Craftsmanship:** Exhibited a level of craftsmanship expected of accomplished professionals in this area. | **20** | **15** | **10** | **5** | **0** |  |
| **Response to Design Questions:** Did the team provide adequate responses to any questions (listed below)? | **20** | **15** | **10** | **5** | **0** |  |
| **TOTAL POINTS** |  |  |  |  |  |  |

## 

## SKILLS CHECKLIST

Write each learner’s name in the column on the left. Write the process skills and content-area knowledge that learners should be able to apply to solve technological problems across the top row. Indicate the degree to which each learner can use the process and content skills to solve technical problems by making the following notations in the boxes where the columns and rows intersect:

**“U” (Unacceptable)** = Learner can’t apply content and solve technical problems

**“I” (Intermediate)** = Learner can apply content

**“S” (Superior)** = learner can apply content to solve problems at a high level

**PROCESS SKILLS/CONTENT AREA KNOWLEDGE**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **LEARNER’S NAME** |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |

## INSTRUCTOR’S ROLE DURING PROBLEM SOLVING ACTIVITIES

The role of instructor once involved being the "bearer of information" or "imparter of knowledge." However, knowing all that we do about the best way to help people learn, your role as an instructor is more like that of a facilitator. You are there to direct and guide; to help learners question and interpret. Some of the responsibilities of instructors when facilitating are as follows:

* Provide the foundation for learning experiences. Instructors are responsible for setting up learning activities, providing learners with objectives, and then encouraging learners to explore and learn;
* Being a resource for learners. By helping learners find answers for themselves and directing them to information sources, facilitators encourage learners to become more autonomous learners – and less reliant on instructors;
* Maintain a safe environment in which learners can experiment;
* Lead discussions. Helping learners attain their goals without telling them the answers. By asking a learner to demonstrate a skill or state a principle, the facilitator is encouraging the learner to synthesize his own understanding and share that knowledge with their peers. Some questions that instructors might use to enable learners to express their ideas and reactions are:

"Are you saying that...?" (Asking about the learner's reasons)

"Why do you think…?" (Asking about the validity of the learner's statements)

"Couldn't it be right that...?" (Asking for supportive evidence)

"How do you know that ...?" (Asking for supportive evidence)

"How might we find out whether...?" (Asking for alternative possibilities)

Ask questions. Believe it or not, this is one of the most difficult skills for instructors to develop. It takes a great deal of planning and effort to master the skill of questioning. Here are some strategies that many instructors have found helpful:

When conducting a demonstration or discussion, prepare several key questions to get things rolling. This will also help assure that key points will be addressed;

Ask open-ended questions; avoid those that can be answered with "yes" or "no;"

Ask questions that require learners to think critically to explain their observations and draw conclusions. For example, in addition to asking recall questions (e.g., "How many bulbs lit up with one battery?"), ask learners to explain what they have observed (e.g., "Why is there a limit to the number of bulbs that will light up with one battery?"); synthesize what they have learned (e.g., "What can you generalize about all circuits?"); develop predictions based on what they understand to be true (e.g., "What would you predict will happen when more batteries are used?"); and apply what they have learned to other situations (e.g., "When planning electrical circuitry for a new building, what do engineers need to consider?");

Sometimes try answering a learner's question with a question. This causes learners to think more critically and to solve problems on their own (or with other classmates);

After asking individual or groups of learners a question, allow 5-10 seconds of wait time before talking, providing a hint, or calling on someone. This allows all learners to respond – even those who may be unsure of themselves and those who prefer to think answers through before talking about them.

## 

## STRATEGIES TO IMPROVE STUDENT TEAM PROJECTS

Many instructors are beginning to use team-based assignments as a major learning tool in school. One advantage of this instructional strategy is that it helps students to develop the social skills and abilities needed in today’s energy industries. It also promotes independent thinking, collaboration, and problem-solving skills. Any instructor who has used team-based assignments in the classroom or laboratory knows that these assignments can be difficult to manage or evaluation. To overcome these potential problems, I suggest the following guidelines for team-based activity:

1. Generate Commitment: In many cases, the problems that occur during team-based activity can be traced to the lack of student commitment to the project. To generate commitment, try some of the following techniques:

* At the beginning of the course, ask students to write down some transportation topics that they would like to work on during the course and then tie all team-based activities back to this list;
* Use a similar technique to identify specific student interest areas and make team assignments based on that interest. For example, students particularly interested in GIS or GPS technologies could be grouped together on a team;

2. Teach the Teams to Manage: Another reason teams fail is that they do not know how to manage the affairs of a team. In short, they do not innately know how to use time wisely or how to divide tasks equitably. To develop these skills, spend time after the design activity has been assigned assisting the teams as they organize for the task. Specifically, ask the students to:

* Elect a Team leader who is responsible for keeping the team moving;
* List their respective skills and talents;
* Identify majors tasks to be accomplished;
* Establish a timeline, reporting times, meeting times, etc.;
* Divide the labor that needs to be accomplished;

3. Trust Students to Manage Groups: Team conflicts can arise during activities and these can be consuming a great deal of time. One effective solution is to encourage students to manage their own team. If, for instance, a student is not completing their tasks because they are not attending school every day, inform the remaining team members that they should make decisions about whether that person should remain on the team. If they elect to remove that student from the team, they must make certain that they have documented the student’s negligence of duties, and inform the student of their decision.

4. Involve Students in Grading: Grading team work can be a problem because students are accustomed to being graded as individuals. To overcome this problem, use the Team Performance Rubric to evaluate both individual and group accomplishment. This rubric should be provided to the teams on the first day of the assignment and teams should be asked to review the evaluation criteria paying special attention to the fact that they will be evaluated both on individual performance and team function.

In conclusion, effective team-based projects build both knowledge and social skills. They also mirror in many respects the ways in which team function in the transportation environment. Seldom are managers excessively involved in micromanagement of workers, and workers are commonly involved (formally and informally) in the evaluation of each other. So, team-based learning help prepare the students for the workplace of the twenty-first century.

## LABORATORY REPORT FORMAT

Writing the Lab Report

Many instructors require students to create a laboratory report when conducting experiments. This requires students to document what they have tried, things they have learned, procedures they have tried, discoveries made, as well as failures that may have occurred. This report format will help students catalog each of their activities and document their learning experiences. All lab reports must be type-written. In all cases where it is possible, figures and graphs should be generated on the computer and must be properly labeled with appropriate units titles.

Every lab report must consist of the following elements:

1. **Title:** Use a key word or phrase to describe the nature of the experiment, test, or laboratory activity;
2. **Purpose:** Using no more than one paragraph, explain the goals and objectives of the experiment. At some point in this paragraph, a hypothesis should be clearly stated;
3. **Introduction:** In no more than one paragraph, describe the experiment, how it was conducted, what materials were used, etc.;
4. **Methods:** In this section, include a step-by-step outline of the steps completed during the experiment;
5. **Results/Findings:** In this section, describe your findings, summarize any data generated, discuss whether or not the hypothesis can be supported, and include any tables or graphs needed;
6. **Conclusions:** In one paragraph or less, describe the most important things learned from the experiment, what the results told you, what else needs to be done in the future.

**Note:** Make sure that the author or authors properly sign the lab report and double check for any spelling or grammatical errors before submitting the report to your instructor.

**THE PORTFOLIO**

The student portfolio is also an essential component of performance-based assessment. Portfolios provide the course instructor with insights into the talents and abilities of individual students, and allow the student to validate and prove their work in these courses. It is recommended that the portfolio be electronic, but a portfolio may also be maintained in a binder as well. By using an electronic format, student portfolios can include written papers, scanned or digital photos, laboratory reports, video and sound clips, drawings, animations, and student recordings. The portfolioshould be concise, organized, and demonstrate the accomplishments of the student in the courses that they have completed. They should include the following components:

* A table of contents page that includes a photo of the student, a biographical sketch, a resume, and general information as well as folders for each course in the curriculum;
* Each course folder should include the following sections:
  + Written papers;
  + Homework;
  + Oral report outlines;
  + Multimedia presentations;
  + Photographs and animations;
  + Graded work;
  + Safety tests;
  + E-mail correspondence;
  + Test results
  + Career information;
  + Honors received.
* A summary page that is continually updated as the student progresses through the curriculum.

One on-line resource for student portfolios can be found at: <http://electronicportfolios.com/portfolios/howto/index.html>

This web site will walk students through the stages of development and allow them to end with a portfolio that they can use in all courses.